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MODEL AIRPLANE NEWS

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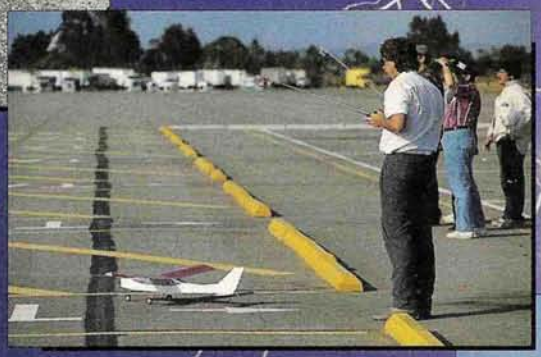
November 1989

48120

THE WORLD'S PREMIER R/C MODELING MAGAZINE

USA $2.95

ELECTRIC POWER!



BLITZKRIEG... 9 3 8 ELECTRIC

5 ELECTRIC VALUATIONS

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Charge on Ni-Cds!!

11

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NOVEMBER 1989 VOLUME 117, NUMBER 11

MODEL AIRPLANE

ON THE COVER: Electrifying? You bet! The only aircraft on this month's cover that isn't powered by batteries is Paul Tradelius' heli at the top of the page. Hal deBolt's Blitzkrieg, our construction plan this month, heads up an all-electric parade, which includes Field & Bench Reviews of Midwest's Aero-lectric, CGM's Sophisticated Lady and Great Planes' ElectroStreak. The background for all these subjects is the still-experimental MAN Ultra-Quick Charger, which still needs to have some of its bugs worked out (like surge protection!). Spectacular lightning-bolt photo by Visual Horizons.

FEATURES

CONSTRUCTION

HELICOPTER SECTION

COLUMNS

DEPARTMENTS

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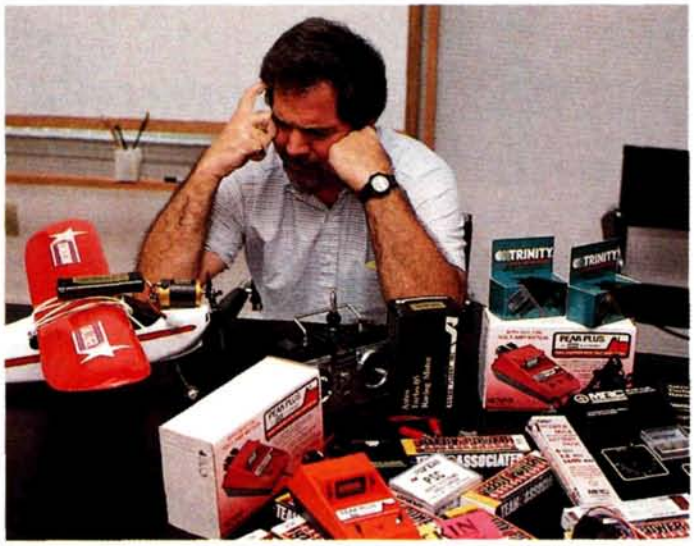
Editorial

by RICH URAVITCH

ELECTRIC *POWER!*

LIVE BETTER electrically! Can this slogan, used many years ago by one of the more famous appliance manufacturers, be accurately applied to our R/C world today? From where I sit, it seems to be a really strong possibility. Although "better" can have a variety of interpretations, it seems to me that you'd be hard-pressed to find a down side to using electric power. While "electric fans" of long-standing involvement may argue that this aspect of the hobby has been accessible to sport modelers for years, the general feeling of those who hadn't yet tried it was that electrics were interesting, certainly quiet and, for the most part, underpowered. And that was about it.



The performance levels available represented the best possible compromise between the equally quiet, but lighter, rubber band (which provided limited flight time) and the longer-duration, but sloppier (and certainly noisier) glow or diesel engine of around .05 displacement. The airframe design housing the powerplant was generally of lightweight, stick-construction and capable of straight-and-level, around-the-patch flight with an occasional strained loop or roll thrown in to relieve the boredom. In most cases, the modeler yanked out the motor along with a corpulent, low-energy power source called a battery pack, installed his favorite methanol-burning 1/2A and went on his merry, and frequently more fulfilling, way.

You can forget most of that *right now*. Electric power has touched every facet of our powered R/C airborne world—and I mean *every*, including helicopters and ducted-fan jets. Present performance levels leave the earlier efforts as much in the dark as we all were during the August 16 eclipse.

Electric acceptance is gaining gradually; the sub-gas performance is no longer an issue, and it's getting better all the time. It hasn't happened easily, quickly, or inexpensively; things unique, useful, or exciting rarely do. But thanks to the efforts of guys like the Boucher brothers (Bob and Roland), former *MAN* columnist Bob Sliff, Bob Kopski, Keith Shaw, Ted Davey, Mitch Poling and a host of others interested and persistent enough to make it happen, it has. We're grateful that it has, and hope this issue gives you just a little of insight and, maybe, just the "spark" you needed to try electrics!

You know, I think the slogan very much still fits!!

We're developing the look, content and appeal of Model Airplane News so quickly that we occasionally fail to provide the deserved introduction to new members of our team of contributors. In response to your requests for in-depth engine reviews, we've engaged the services of Mike Billinton, whose test lab looks like something straight out of NASA. Mike started with us in the August issue, and your initial responses have indicated that his presentations will become some of your favorites. ■

Rich

MODEL AIRPLANE NEWS
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Publisher
DR. LOUIS V. DeFRANCESCO

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Airwaves

WHERE TO WRITE TO US

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From Bipes to Burners

I really enjoy getting your magazine every month. I've been in this hobby for two years now, and when I saw your article on the Waco YMF-5, I decided to send you a picture of mine. It's from Pica, and it's a very good kit. It weighs in at 13½ pounds, has a 72-inch wingspan and a Supertigre 2500 swinging an 18x6 propeller. I covered it with Super MonoKote and equipped it with a Futaba 7-channel FM to keep it under control.

I'm now building an F-4 Phantom from scratch with twin O.S. 77 engines and Byrojet fan units (1/6 scale). Keep up the good work!

DAVE SOMERSALL
Souris, Manitoba, Canada

Dave, your Waco looks great and won't be short of power with the S.T. engine! One-sixth scale in an F-4 makes the fuselage just short of 10 feet, so it's going to be one impressive airplane. I saw a similarly powered Phantom built by Chris Golds at the recent British fan fly, and it was a real crowd-pleaser. Keep us posted on your progress; we hope to see it at next year's Bay of Quinte Jet Rally in your country.

RAU

Tank Tips

Although I've been into R/C for several years, I've just recently started experimenting with different engines. The most apparent problem is that some engine manufacturers give the fuel-tank location as being the top of the tank, slightly below the needle valve, and this works out fine. Some manufacturers, however, say that the center line of the tank should be slightly *below* the needle valve. Most airplane kit designs don't have enough room to put the tank that high and still maintain the thrust line. Is there any way to overcome this problem?

JIM D. ANTONIO
Media, PA

Jim, aside from positioning the tank at the ideal location and adding a fairing over the top (which, in most cases, will produce a rather grotesque fuselage contour), I suggest that you use the position recommended by the kit or the designers. Most engines have the ability do draw fuel from a slightly low tank with no problem, especially considering that, since mufflers are required, the ability to install a pressure tap enables the use of muffler pressure, which helps regulate fuel flow. Unless the configuration of the airplane demands a really unusual tank location, this system works pretty well. If the tank must be located remotely, Perry Automotive makes a variety of pressure- or vibration-operated pumps that ensure even flow.

RAU

Jet Quest

After reading through the October '87 issue of *MAN* on the Canadian Fan Fly, I'm interested in two models: Dr. Jack Tse's F-14 Tomcat with full-swing capability and Bob Fiorenze's F/A-18 Hornet. Are there kits or plans for these two models? Could you give me information on the two models, or tell me where I can write to to get the information?

CHRIS ROGER

Chris, the F/A-18 Hornet, built and flown by Bob Fiorenze to top honors in both the Scale Masters and Top Gun competitions, is available in kit form from Yellow Aircraft Co., 11919 Canyon Rd. E., Puyal-

(Continued on page 10)

Airwaves

(Continued from page 8)

lup, WA 98373. They also intend to produce a kit of the F-14A, complete with wing-swinging mechanics. Contact them for more details.

RAU

Norwegian Mallard

For the last four years, I've been making a 1/16-scale model of a Grumman G-73 Mallard. Grumman has been most helpful and has supported me all the way with drawings and photos. I couldn't have done this project without its help.

I wonder if someone in the U.S. can help me with the propellers and dummy engines for it. The two propellers are Hamilton Standard Hydromatic (3-blade) and must be 6.8 inches (17.3mm). The two engines are Pratt & Whitney No. R-1340-S3H1 (9-cylinder) and must be 3 inches (7.5mm). Only the fronts of the engines are necessary, since nothing behind them will be visible. I would be most grateful if someone can help me or offer advice.

I'm also most interested in all photos, drawings, etc., of the Mallard, if anyone has material available that I might add to my big album of this beauty. It's a great pity that so little about this lovely queen of the amphibians is accessible in flight magazines and *MAN*. Wake up, airplane buffs: You miss a wonderful airplane in the Grumman Mallard!

JAN RAABE
Box 75
N-4275 Sevlandsvik
Norway

Well, global modelers, if there's anyone out there who might be able to help out, please contact Jan directly; his fjord apparently has run out of better ideas!

RAU

Liaison Lover

Please let me know if you have a good and accurate three-view plan of a Vultee L-5 (commonly and erroneously called the Stinson L-5). I'm not particularly interested in a model plan, unless it's about the equivalent of a Cleveland plan, or if nothing better is available.

So far, the best I've located from other plans suppliers is a very poor three-view of about 7-inch wingspan.

I plan to build a 3/4-size scale replica of an L-5 that will be classed as an Ultralight under the FAA's part 103 (or Experimental, if I can't make it light enough).

If you have a good plan, let me know size, scale, price, etc.

R.F. "CASEY" HOLM
Newburg, OR

Well, Casey ol' buddy, we've combed our extensive line of drawings and can't find anything that might work to help you produce your 3/4 L-5, and scaling it up from the 7-inch three-view you already have is no mean task. Berkeley used to make a kit that, as I recall, was pretty accurate and would at least serve as a starting point, since most ultralights today appear to be overgrown models, anyway. You might try contacting the newly formed Int'l Liaison Pilot and Aircraft Association (16518 Ledgestone, San Antonio, TX 78232). I just received their newsletter, and since their whole purpose in organizing is to preserve the "L-Birds," they'd probably be the most helpful. Good luck, and keep us advised.

RAU

Worried With Wires?!

I'm writing in regard to the photo of the Staggerwing Beech on page 44 of your August '89 issue of *Model Airplane News*. In all my years of rigging biplanes, full-scale as well as models, I've found it essential to have the flying and landing wires taut to a specific torque value. The photo to which I refer shows the rigging wires loose and flapping in the wind. Are the wings about to depart the scene, or has the modeler/pilot forgotten one of the basic rules of pre-flight?

Flying a full-scale aircraft in this condition would be disastrous, and doing so with a Byron kit (or any other kind) seems detrimental to safety as well as to the prestige of those involved.

Your publication is great, but presen-

(Continued on page 12)

Airwaves

(Continued from page 10)

tations of photos like this really scare me. Fortunately, the photo is from the rear quarter rather than oncoming!

W.R. HELVERSON
Sparks, NV

*Mr. Helverson, thanks for taking the time to write and express what could be interpreted by those unfamiliar with our sport as a potentially dangerous condition. Our models, especially those of the scale variety, frequently have details like flying/landing wires added to enhance the cosmetics and authenticity of the subject. Just as frequently, these additions are non-functional and non-load-bearing. Mel Santmyer's Byron Beech G-17, to which you refer, is just such a model. It's designed to fly quite happily throughout its envelope without the wires. It's well-designed and, if assembled correctly, its wings will never "depart the scene." But again, thanks, and I believe landing and flying wires are rigged to a **tension** rather than a **torque** value.*

RAU

Paternal Plane Plight

Perhaps your readers can help me with a small problem. My dad mentioned how much he'd like to build a Top Flite Taurus, a favorite of his from years gone by. I'd sure like to find a kit for him for Christmas, and I'd be glad to hear from any of your readers who might be able to help.

TOM GROGG
18 Mallard Dr.
Mahomet, IL 61853
(217) 586-4342

*Tom, I can appreciate the request, so I've printed your full address, along with your phone number, for the many readers whom I hope will respond. My guess is that, with the resurgence of interest in "Vintage" R/C, designs of that era like Taurus, Tauri, Smog Hog, Beachcomber, Daddy Rabbit and Kwik Fli are going to be a little difficult to come by, but I'm confident that the readers can help. Incidentally, **my** Dad has seen the boss's Testarossa and has been humming "Jingle Bells" for the last three months...can **you** help??*

RAU

Retract Research

Can you help me in researching two things? First, I need to know if you or any other magazine has published a review or article concerning the Jet Hangar Hobbies F-4 Phantom II.

The other thing that confuses me, as I'm a newcomer to this sport, is the vast array of retracts. The only retracts with which I'm familiar are the mechanical ones that are operated by a servo.

If you can give me any information on either of these subjects, I'd feel in debt to you. Thank you for your time and effort.

ROBBIE BAYAN
Palo Alto, CA

Robbie, consider the debt settled when we receive your subscription! We haven't done a Field & Bench Review of the JHH F-4, but have reported on it in past installments of Jet Blast, our ducted-fan column. From what we've heard, it's an excellent flying airplane.

Retracts are usually operated either by mechanical linkage from a servo, or by air that's directed through flexible lines to a cylinder, which is attached to the retract unit. The air is stored in an on-board tank, and flow is controlled through a two-position valve. There are sizes available for nearly any model right up through the giant scalers. Contact any of the manufacturers for additional details.

RAU

Tigre-Powered Texan

I've enclosed a picture of my latest model, an AT-6 that weighs 10.5 pounds with Supertigre 75 power. So far, I've managed its scale-like quirks, like dropping the left wing at slow speed. It has air retracts, split flaps and flies on Aristo-Craft 720 gear. The dealer wanted me to fit a 4-stroke 1.20 engine to give realistic sound. I asked him if he had ever heard a real AT-6! (We called them Harvards during the war.) The S.T. 75 is about right in giving the same number of "pops per minute" as the direct-drive Wasp at 2200rpm. What's with these 4-stroke people?

The Goldberg lads will be pleased to hear that I'm still flying my 27-year-old Senior Falcon, which flew with the original Kraft Propo Gold and, before that, with reed gear. It's the envy of my friends because of its ability to fly in strong winds when everyone else has quit or crashed. I use an old Supertigre 60 on it. The thick wing gives a stability and speed control we don't get on the new, "improved" designs. The proper sectioned tail smooths out the longitudinal flight, and the low wing loading provides a smooth landing pattern down to zero speed.

ERIC FEARNLEY
Grimsby, South Humberside
England

Eric, it's good to hear from you again. The Harvard looks smashing and deserves the "fire and brimstone" effect that only a hot 2-stroke can provide. You didn't mention whether or not it's one of your designs, plans, or kits. If it's an original, we'd sure like to see the plans!

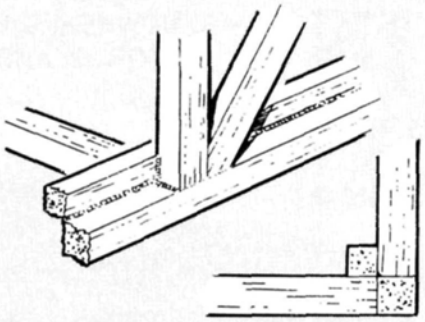
For some of you newer readers, Eric is a very talented, 69-year-young, British modeler whose scale designs have appeared as construction articles in MAN.

RAU

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and length.

Hints & Kinks

by JIM NEWMAN



FUSELAGE STRENGTHENING

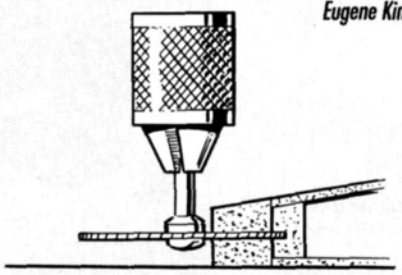
This is a unique method of strengthening a stick-built fuselage without having to resort to gussets. An additional smaller-section longeron is set along the *inside* of the completed frame at all four corners and glued at *all* contact points with CA (which is ideal for this). It's especially important to glue the longerons corner-to-corner. Notice the additional shear strength given to the joints of the uprights and diagonals. This idea was used to reinforce a 50-year-old clipper for R/C.

Stan Rutz, Muskegon, MI

SUSPENDED STORAGE JARS

This modeler reminds us that there's plenty of storage space *under* your workshop shelves. Just screw the lids of your small parts jars under the shelves, then screw the jars up into the lids, and have your parts conveniently on hand.

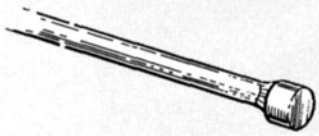
Eugene King, Buffalo, NY



SAWN HINGE SLOTS

Here's a neat, accurate way to cut hinge slots, and it's probably a lot faster than the old "dig-and-rake" method. Put a miniature circular-saw blade into your drill chuck, then lower the drill press until the blade is exactly on the center line of the trailing edge. Start the drill, then bring the trailing edge against the rotating saw blade to the required depth. Just watch those fingers very closely!

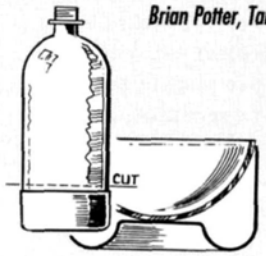
Dwight Minnich, Long Beach, CA



RETRIEVER FOR SMALL SCREWS AND NUTS

Steal that small magnet off the refrigerator door, then glue it firmly to the end of a dowel. With this tool, you'll be able to fish out any metal items dropped into the depths of the fuselage. Just keep the tool away from servos containing permanent magnet motors (same comment applies to those trigger-operated, instant-heat soldering guns, too!).

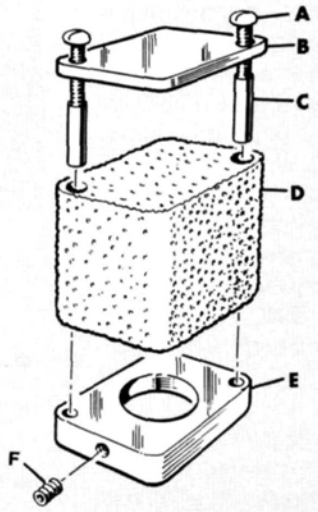
Brian Potter, Tamworth, NSW, Australia



USEFUL PLASTIC BOWLS

The price is right! Cut the bottoms off those big soft-drink bottles, retaining their black plastic bases. These rounded "bowls" are useful for mixing large quantities of epoxy, washing engine parts, etc., and, unlike foam or paper cups, that plastic base is very stable.

Robert Langford, Sandy, UT



REUSABLE FOAM AIR FILTER

Easily constructed with simple hand tools, this filter is a must on dusty fields that will quickly destroy your engine. The porous foam element (which can be sawn off a lawnmower filter) can be removed, washed in gasoline, soaked in a light oil then put back on your engine. (A) 6-32x¾-inch machine screws; (B) 1/16-inch-thick aluminum top plate; (C) 7/16-inch-long brass tubes; (D) 1-inch-thick foam-plastic filter; (E) ¼-inch-thick aluminum plate; (F) 6-32x¼-inch setscrew. The hole in the lower plate is sized to fit snugly over the carburetor intake where it's retained by the setscrew.

Dwayne Bardarson, Riverton, Manitoba, Canada

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

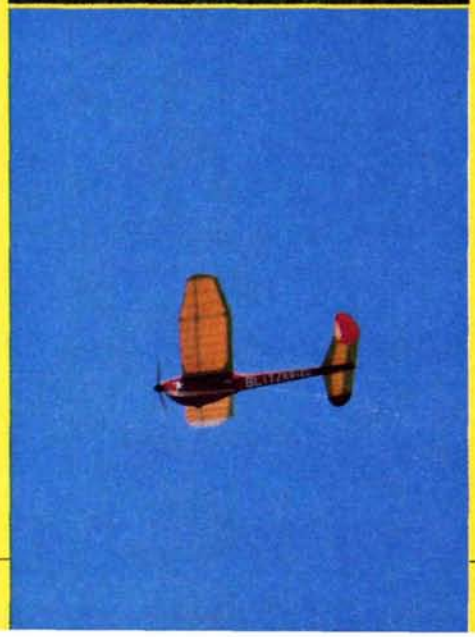
CONSTRUCTION

ELECTRIC

BLITZKRIEG

by HAL deBOLT

BLITZKRIEG! AN UNUSUAL name for a model airplane?—not in 1938, when Hitler was making headlines! At the time, this name seemed perfect to describe this model's exciting free flight, and



RENAISSANCE PLANE:

Old Time gas free-flight updated to electric R/C

the Blitzkreig was my first successful competition gas model. Today, 1938 seems like eternity ago, and it's wonderful to be flying again what once did so well for me and to be able to compare the original's flight with that of this newcomer. What memories!

The Blitzkrieg was the final form of a simpler preliminary design that proved the merit of the concept. As you can see, the layout was typical of the time just before "pylons." This embryonic free-flighter was shown the value of stability in achieving a superior contest performance. The Blitzkrieg had the inherent spiralling stability and power control that was much sought after then. It was achieved by the judicious location of lateral area, the lifting stabilizer and the high thrust line.

Blitzkriegs were built in two sizes that were able to cover all three classes of FF: A, B and C. There was one of about 330 square inches to handle the .19 and .23 Ohlsson engines and a larger one to suit the Forster .29 and .305 engines. Flown in all three classes, they won their share of trophies in area meets. Six were lost in one season so I realized the dire necessity of developing a dethermalizer for my next design! The plane's rate of climb was its greatest asset; it clawed upward in a tight spiral, and the timer judge often complained it was too high to hear its engine shut off at 20 seconds!

With its electric power and R/C, this replica of the 1938 version takes full advantage of modern technology. Why not

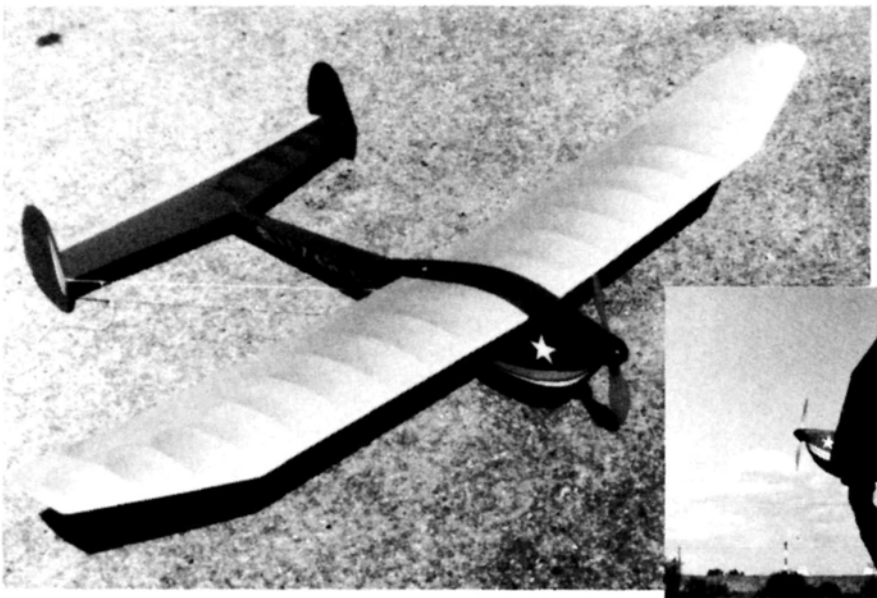
combine nostalgia with contemporary developments? The B-C size just happens to fit the parameters of a high-performance 05-powered endurance type. I had carefully studied Bill Winter's outstanding Heron electric and was happy to see how closely this OT FF matched his layout—aerodynamically, that is. So the die was cast; I would build an electric like Bill's, but retain an element of nostalgia.

I set a goal of 45 ounces for this version and was pleasantly surprised with its actual flying weight of 40 ounces (and this with the heavier R/C and power batteries!). I hadn't even paid special attention to us-

SPECIFICATIONS

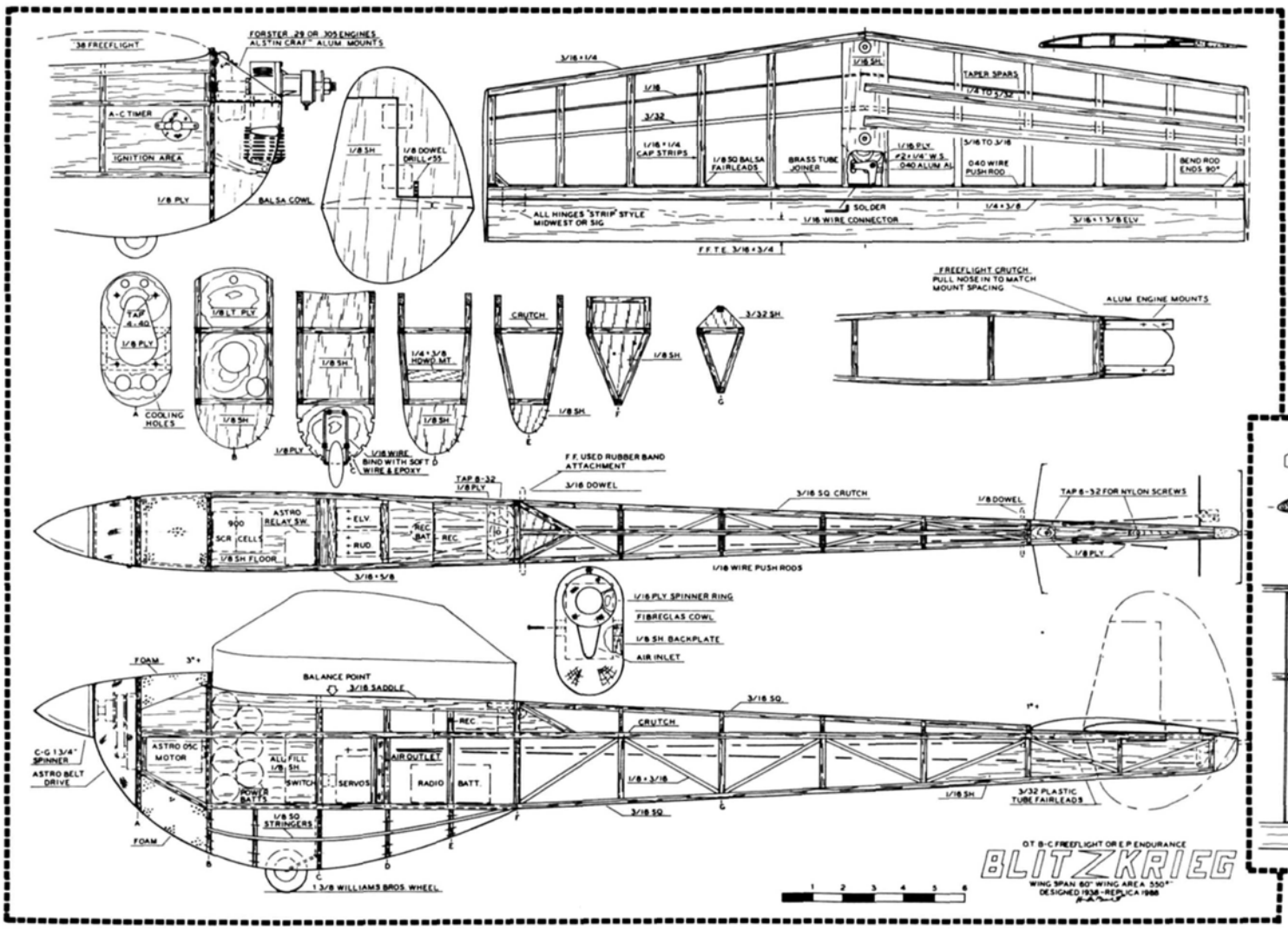
Wingspan: *60 inches*
Length: *39 1/2 inches*
Weight: *40 ounces (ready to fly)*
Wing Area: *550 square inches*
Wing Loading: *10 1/2 ounces per square foot*
Power Req'd: *05 Cobalt with 3.3:1 gearing; 7.2V Ni-Cd pack*
No. of Channels Req'd: *2 (mini system recommended)*
Material: *Balsa and ply*
Comments: *Although convertible to glow power, this replica of a 1938 free-flight design is right at home with electric power and R/C guidance.*

BLITZKRIEG

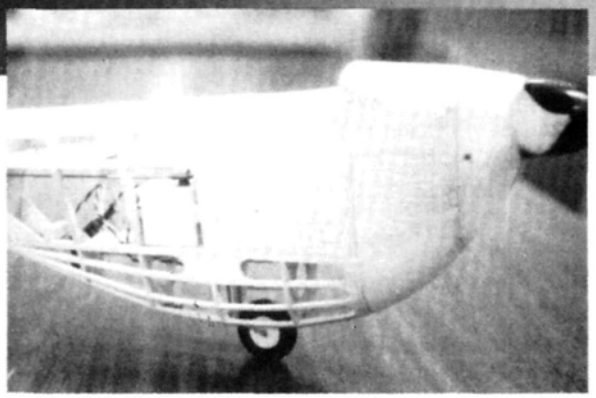


Polyhedral wing enhances stability and directional control.

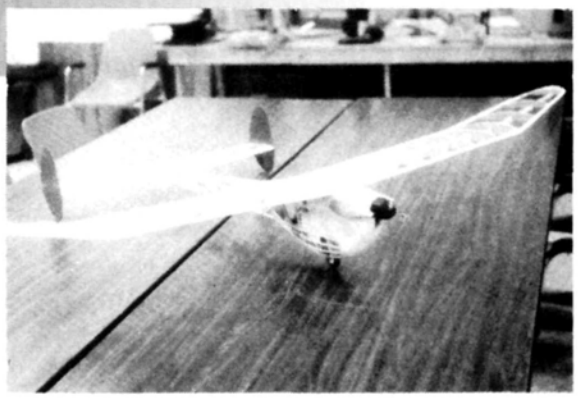
Left: Friend Chet Lanzo ready for first flight-launch.



Wheel pod and tail boom added to basic structure.



Finished nose section of fuselage.



Blitzkrieg ready for covering; airframe weight, only 9 ounces.

ing lightweight balsa! This 550-square-inch bare-airframe weight was a miserly 9 ounces (13 ounces with covering).

For power, an Astro* 05C with a 3.3:1 belt drive used seven 1.2 SR 1200mAh cells to turn a 12x9 prop at 4,000rpm. This power unit draws 11 amps of current. A fine Airtronics* "mini system" contributes nicely to the lightness and operates flawlessly. The smallness, low weight (less than 5 ounces) and positive response with ample servo power of this FM Airtronics system is amazing!

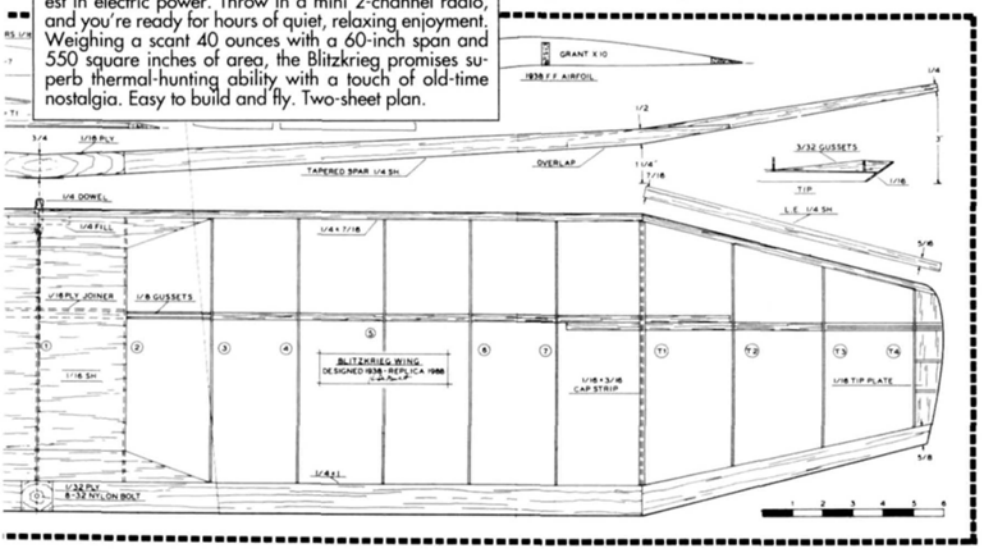
The B-C size was powered with ignition Forster .29s and .305s, which allowed entry in both classes without trim changes. The ignition components were mounted where the electric batteries are shown, and the FF weight requirement was met by choice of ignition battery size.

When you try a new design, you hope for improved performance. My FF designs always resorted to the popular pylon configuration; looking back, I wonder why, for the Blitzkrieg's performance would have matched that of the best of them!

For you S.A.M. types, I'll recall the original Blitzkreig's FF performance. The single-wheel takeoff required a slight quartering to the right of dead upwind to counter the initial effect of torque. The climb would be a right spiral, rolling into a right-glide circle, which was adjusted by pivoting the entire stab. With R/C rudders, the stab would remain stationary, of course. Spiral climb was adjusted by shimming the metal engine mounts. The most that was ever needed was a little right thrust—perhaps the thickness of a paper match, at most? Balance was in the 45- to 50-percent (wing chord) range, adjusting in dead air until the best L/D was found. The lifting stab effectively controlled power, so the CG wasn't critical.

#11891 BLITZKRIEG $10.00

The prolific Hal "Pappy" deBolt recalls some of his early modeling experiences by redesigning this popular 1938 free-flight design to take advantage of the growing interest in electric power. Throw in a mini 2-channel radio, and you're ready for hours of quiet, relaxing enjoyment. Weighing a scant 40 ounces with a 60-inch span and 550 square inches of area, the Blitzkrieg promises superb thermal-hunting ability with a touch of old-time nostalgia. Easy to build and fly. Two-sheet plan.



ORDER THE FULL-SIZE PLANS...PAGE 106

The Structure

A cursory look at the plans and photos reveals the basic "stick-and-tissue" concept of the early days. In general, it should be remembered that strength depends on the use of firm balsa for all longerons and for the crutch, while most uprights and all "fill" can be of lighter wood. The monospar wing requires a careful choice of wood; look for the "long-fiber," firm material that doesn't necessarily have to be heavy. Do I have to say, "Use Hot Stuff for all assembly"? It's quick, light and strong.

The Wing

You must choose between the authentic Grant airfoil and the Eppler 193 used in this replica. Modern foils do have a much better L/D ratio, and drag is an absolute no-no with electric. I chose the Eppler. The two schools of thought for wing design (turbulent and laminar flow) were just as evident in the '30s as they are today. Multi spars can produce turbulent flow; laminar requires an unbroken surface (as with a monospar). Laminar creates much less inherent drag, and you must be drag-conscious for windy conditions (as my FF area usually had). Add to that the simplicity and lightness of a single spar.

The Blitzkrieg has only a few unusual structural features, so I'll detail them rather than doing the "glue-A-to-B" bit.

The wing may obviously be assembled simply on a flat, or dihedral, board. (Note the tapered spars, which are cut from 1/4-inch sheet.) When notching the ribs, start

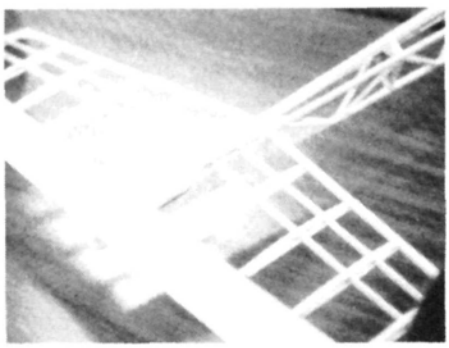
all at minimum notch depth and deepen the notches as required when installing them. Otherwise, it's easier to install the overlapping tip spars after the polyhedral has been established with the leading and trailing edges.

Stabilizer and Rudders

For these, instructions seem appropriate, because the R/C version was complicated by the need for operating twin rudders. This was neatly accomplished by connecting the rudders with a light wire pushrod and then acuating the rod with a small aluminum bellcrank. One-eighth-inch-square drilled balsa fairleads prevent the pushrod from flexing.

The cap-strip ribs effectively create a lifting airfoil that's so important to control power with this design. Use stiff balsa for the caps and soak the upper caps in ammonia water to bend them. Start assembly with the leading and trailing edges, plus the lower caps. Pay close attention to the tips; keep them square to the trailing edge to ensure proper fin alignment. At this point, the rudder mechanics must be installed.

Make the required bellcrank from aluminum alloy. On top of the lower center-section sheeting there are two ply attach-

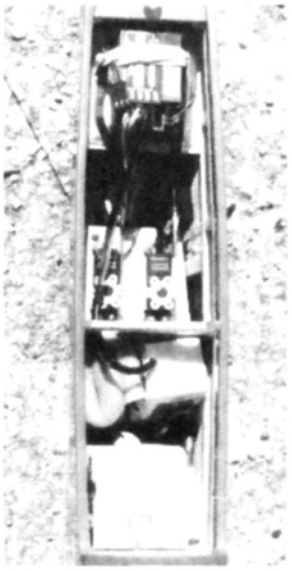


Stabilizer details; note cap strip ribs.

ment screw mounts. The rear one is longer so that it can double as the bellcrank mount.

Cut some 1/8-inch-square balsa into six 3/8-inch lengths. Center-drill these fairleads with a 3/64-inch drill in a pin vise, or better yet, a drill press. Take a long piece of .040 pushrod music wire and slip the 1/8-inch-square fairleads onto it. On the stab structure, locate the fairleads and push the rod as indicated. Tack with CA (the pushrod should move freely).

The bellcrank pivot is a No. 2 wood screw. Find its proper position on the ply, and mount it by aligning the bellcrank



Simple equipment installation for easy maintenance.

with the pushrods. Next, size and taper the four spars from sheeting and install them. Now the soaked upper caps can be shaped with your fingers and cemented into place. Leave the stab to dry while you make the fin rudders.

The fin rudders are shaped from medium 1/8-inch sheet. Sand a simple airfoil into them, making a 1/32-inch edge at the trailing edge. When they're completed, the rudders can be separated with a sharp razor and a metal straightedge.

Remove the stab structure from the building board. At the bellcrank pivot point, remove a 3/8-inch-square piece of the bottom sheeting, and replace it with 1/16-inch ply to ensure a secure mounting for the pivot screw. Finish block-sand as much of the structure as possible.

Next check-square the stab tips to the trailing edge; then cover the fins and align and install them on the stab. Hinge the rudders to the fin temporarily (don't cement!). Strip hinges work best for these thin surfaces. The rudder pushrod pivot is a 1/2-inch length of drilled 1/8-inch birch dowel cemented into a slot in the rudders. With the rudders in place, find the slot with the pushrod and install the dowels. The .040 wire pushrod has 90-degree bends at the ends so that it can actuate the rudders. The rod is in two pieces that are joined near the center with 1/16-inch brass tubing and solder, which provides an adjustment capability. Simply zero the servo and the control surface, then solder the connection permanently.

Install the right-hand pushrod and rudder. This side is attached to the bellcrank

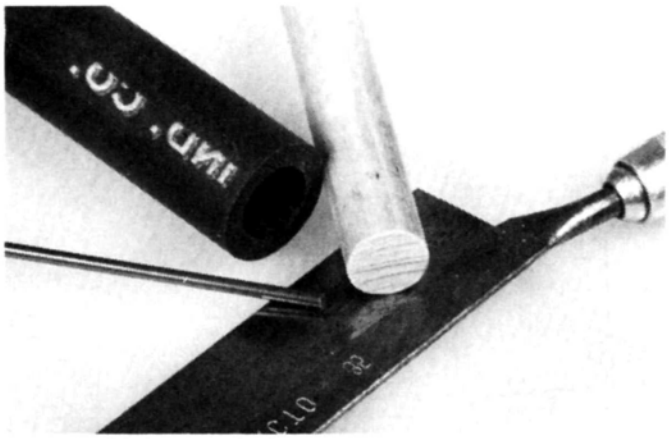
(Continued on page 57)

How To:

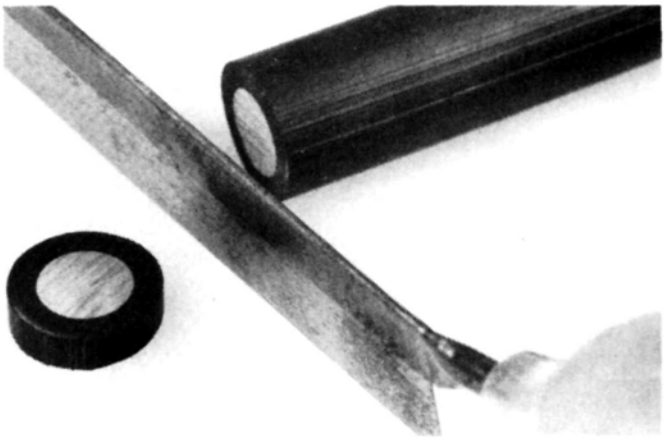
by RANDY RANDOLPH

MAKE SUPER TAIL WHEELS

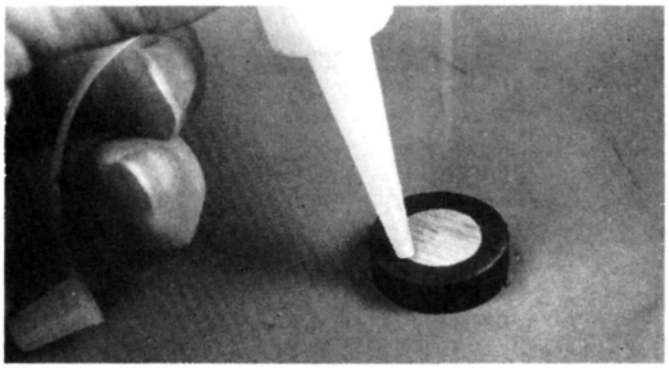
The steerable tail wheel is a very important part of a conventional landing gear; without it, there's little or no ground control. The photos show how to make a light, but tough, tail wheel that will stand up to years of landings.



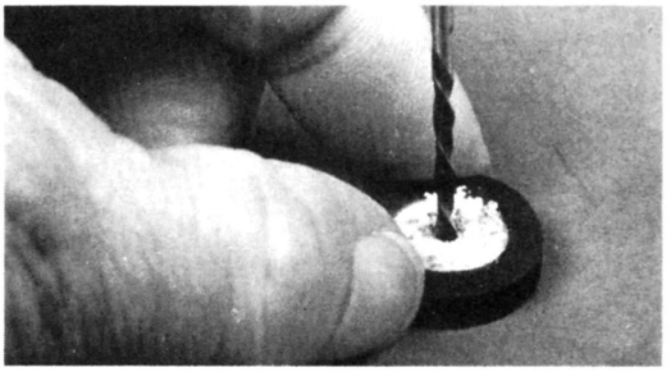
1. *Materials needed: a length of 1/2-inch-i.d. heavy-duty rubber hose; a 1/2-inch hardwood dowel; and a short piece of 3/32-inch brass tube. Tools needed: a saw and a 3/32-inch drill.*



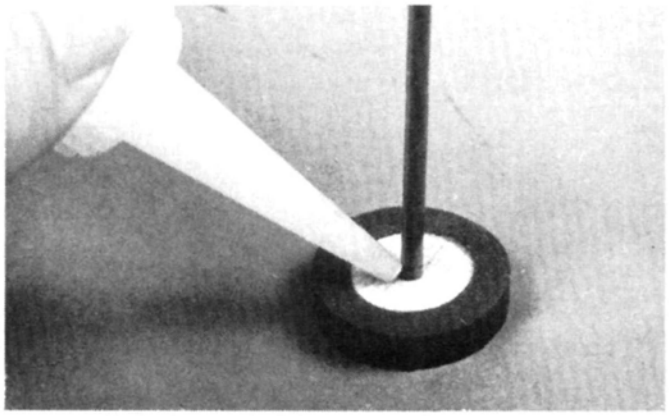
2. *Push the dowel into the hose (it will be a tight fit), and saw off a 1/4-inch slice of dowel and hose. (Suitable hose can be found in the plumbing-supplies department of most hardware stores.)*



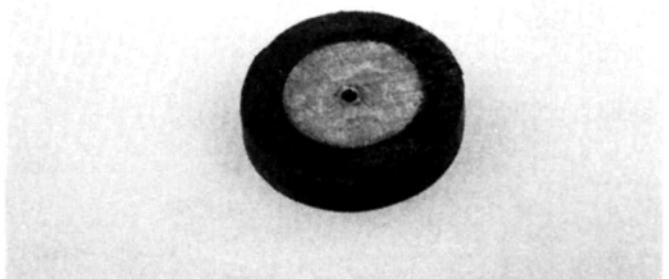
3. *Apply thin CA to the dowel/hose seam all the way around on both sides. If you prefer, the dowel could be epoxied into the hose and a band saw used to slice a number of tail wheels at a time.*



4. *Locate the center of the wheel by drawing a series of lines across it, then center-punch and drill it with a 3/32-inch bit.*



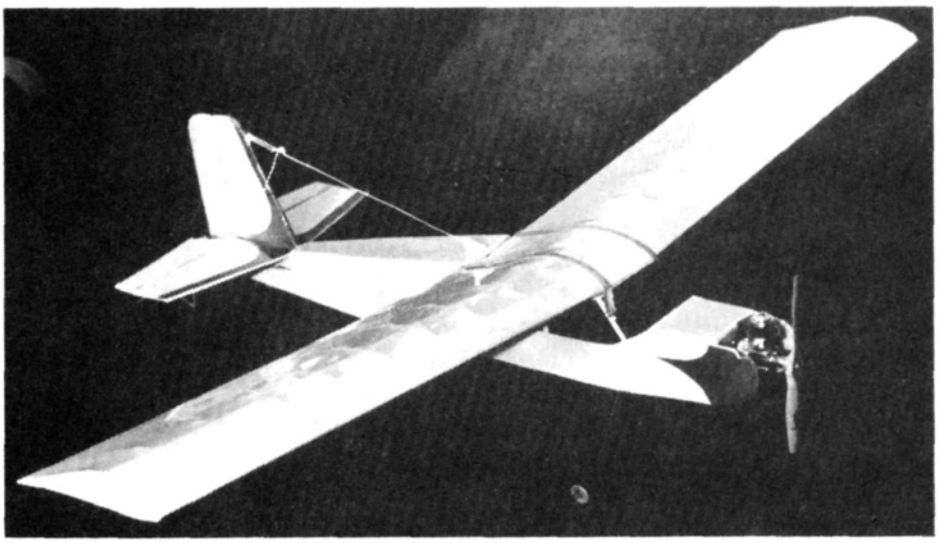
5. *Put the 3/32-inch brass tube through the wheel until at least 1/16 inch protrudes from the rear, and apply thin CA to the tube/wheel joint on both sides.*



6. *Saw the tube flush with both sides of the wheel hub, and your tail wheel is complete. A wheel of this type has made hundreds of landings with no visible signs of wear!*

Small Steps

by RANDY RANDOLPH



This airplane was designed and built based on Joe Wagner's advice in the Dec. '88 "Small Steps" column.

THERE'S A GROUP in England that espouses a philosophy that is so dear to our hearts that it's high time those of us in the "colonies" should follow suit. Dereck Woodward, who dwells in "the old country," had some nice things to say about "Small Steps" and brought the following to mind. I quote from Dereck's letter:

"...Peter Miller, a fellow columnist on *Radio Control Model World* magazine, had had enough one month of the egotistic rambling of the Large Model Assn. over here, so he invented the SMA in his column. The aims were that anyone who loved flying small models and didn't take things too seriously was eligible to be a member. He invented a few other points, then signed off with 'don't apply for membership—I made this up.'

"That was two months back. We now have official badges, T-shirts and even ball caps...There are three magazine columnists behind the SMA and a nationally known model shop as well, plus a fast-growing non-membership. We even have open non-memberships for the free-flight and C/L modelers..."

Thank you, Dereck! As of now, an organization dedicated to the preservation and encouragement of small airplanes has been founded in the good old USA. The Small Model Airplane League (SMAL) is now called to order!

Membership is open to all modelers anywhere who will meet the following requirement. Face toward the SMAL National Headquarters in Dallas, TX, place the right hand over the heart and say the membership pledge: "I promise to enjoy and promote the building and flying of small model airplanes." Upon completion of the pledge, the modeler is an instant member of the League. Join today!

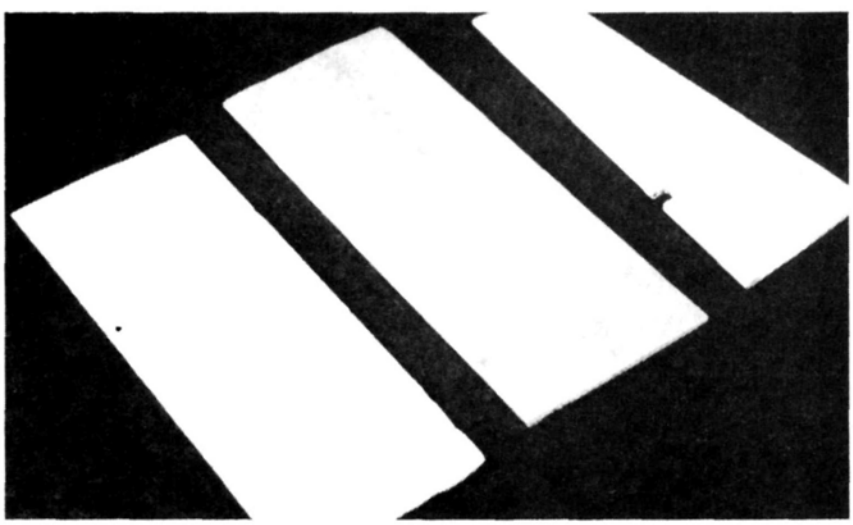
Mr. Joe Wagner is currently developing a worthy insignia for this fine organization. Naturally, the SMAL insignia will be copyrighted so prurient interests cannot use it for crass commercialism. The rules committee is now hard at work on the wording of the other rule. Something like "there shall be no other rules" has been suggested, but some on the committee are insisting on a third rule which would state: "These rules can never be amended." The deliberations continue! It is hoped that at some time in the near future, membership cards, etc., will be available to all members in good standing.

If the SMAL is successful and the membership approves, we might just ask for non-affiliation with the English group.

This has been the month for inspiring letters, and the following definitely falls into that class. Let me introduce Ian Sigman of Oakland, CA. Ian's airplane is pictured, and here's his letter:

"I'm an avid reader of 'Small Steps' in *MAN*, and I often refer back to articles in old issues. I was especially excited about your December '88 'Small Steps,' where you gave the general proportions for a (hopefully) successful model airplane

(Continued on page 116)



John Vasey returns with information on making your own foam-core board. (See text.)

First launch, and the PT-Electric is up and away! Model has a moderate climb rate and flies slowly enough to give beginners time to learn and react.

SPECIFICATIONS

Type: *Electric trainer*
Wingspan: *56 inches*
Length: *38 inches*
Weight: *45 to 50 ounces*
Wing Loading: *12.9 to 14.4 ounces per square foot*
Motor: *Thrustmaster 05 (Mabuchi can motor)*
Propeller: *8x4 Grish*
Battery: *7.2V 1200mAh*
Radio Req'd: *3 channels (rudder, elevator and speed controller)*
Sug. Retail Price: *$69.95*
Features: *Specifically designed for electric operation. Uses a turbulated, flat-bottomed airfoil section for maximum lift. In addition to building sequence, instruction book included information on glues, covering and flying.*
Comments: *An excellent kit that will serve not only as an excellent flight trainer, but will teach good, basic building techniques as well. When equipped with an effective speed controller, it handles like any similar glow-powered trainer.*

GREAT PLANES

PT-ELECTRIC

Although the PT-Electric has simple lines, the finished model is quite striking, with its yellow and transparent blue finish.

Continuing the PT tradition, electrically!

by JOHN LIPPERGER

DON ANDERSON, who designed the PT-Electric for Great Planes Model Manufacturing Co.*, obviously understands what a good electric trainer should be: Structurally and aerodynamically, the PT-Electric will deliver the performance that a beginner needs.

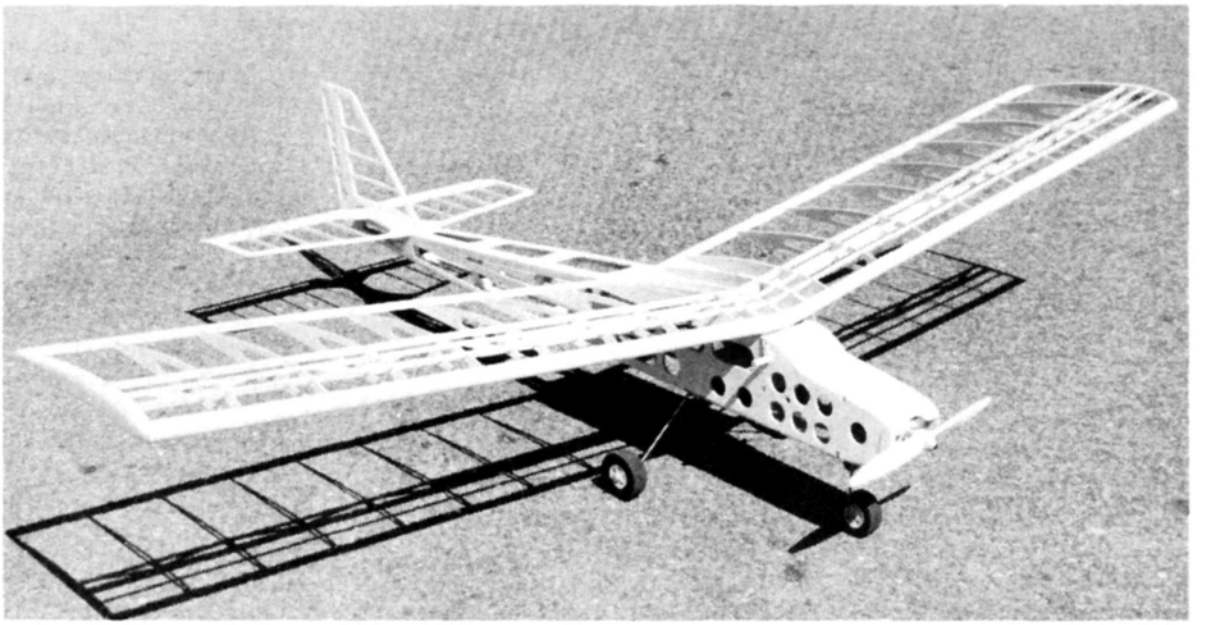
One of the model's most striking features is its structure. As you check out the plans and instructions, it's clear that this isn't a converted power model: It's more of a cross between a glider and an old-timer—a perfect combination for an electric model. The PT-Electric uses a thick, turbulated, flat-bottom airfoil for maximum lift at slow speeds. It has a relatively long tail moment, which helps dampen control inputs, and its generous tail volume adds stability.

THE KIT: The kit arrived in good order, and I was somewhat surprised at the smallness of its box. After all, this is a fairly large model that comes with a motor, a microswitch and a prop. When I opened the box, it was about as full as it could possibly be, and all the stick

PHOTOS BY JOHN LUPPA

wood was neatly bundled, the sheet wood was stacked and rubber-banded, the hardware was bagged, the motor and the accessories were boxed, and the full-size plans were neatly rolled. Not a square inch of the box was wasted!

The die-cutting was of a high quality, and all the parts were easily removed from their sheets. A lot of the wood in the kit seemed to be too hard, but I later found the reason for this: No excess material or structure is used in the construction of the PT-Electric. All major parts have lightening holes in them, and there are additional tips on how to keep your finished model light. If softer, lighter wood were used, the structure would be too weak to carry the electric flight components.



The rolled plans are printed on both sides; they're well done and easy to read and understand. One of the finest features of the kit is the instruction booklet. This 44-page booklet not only takes you step-by-step through construction, but it could also pass as a basic introduction to R/C. It covers the basics of electrics, glues, construction, covering, flying and safety.

The Thrustmaster 05 motor is a Mabuchi can-type motor. It comes with steel stator ring that helps contain the motor's magnetic field and increases its efficiency. By removing the ring, you could expect an increase in rpm, but a shorter flight time. A Grish 8x4 prop is provided, and it worked well with the Thrustmaster motor.

CONSTRUCTION: The instructions say that you should first identify and mark all the parts. This is a very good suggestion that should be mentioned in every kit, as it can save time and frustration during construction. After all the parts have been marked and separated, construction begins with the fuselage.

The first step is to prepare the landing-gear plate. The wire gear is held to the ply plate with nylon gear straps. After mounting the wire, several holes are drilled in the plywood plate to lighten it and to provide an air exit for cooling the batteries. The battery hatch is then hinged, mounted to the ply fuselage bottom, secured with a ply hatch-locking tongue and set aside.

Two small ply plates are glued to the back of the fire wall to reinforce it where the nose-gear mounts are positioned. The nose gear is held in place with two nylon gear straps. The remaining bulkheads are then readied for actual fuselage assembly.

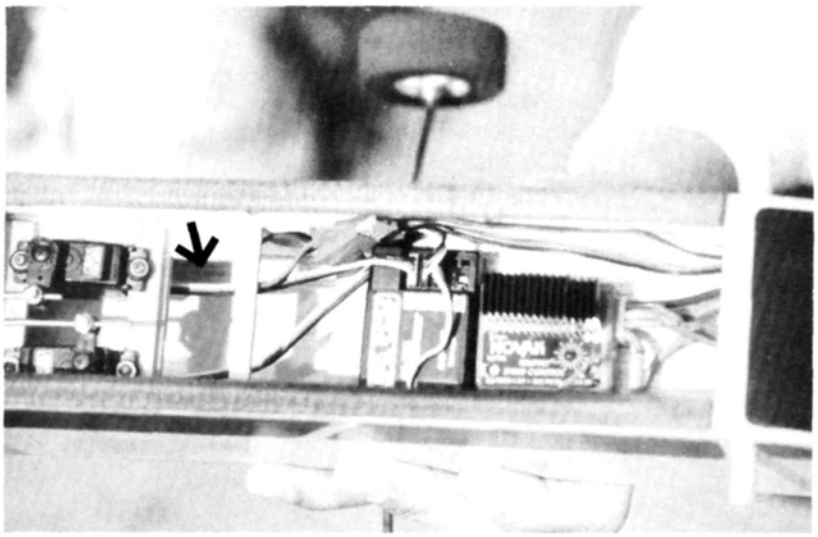
The forward fuselage section is secured to the building board, and the rear longerons are glued into place. The position of the rear bulkheads is then marked on the fuselage side. After gluing the longerons into place on the other front fuselage side, the two sides are put top to bottom, and the rear bulkhead locations are transferred to the second side. The front bulkheads are then set into the notches in the fuselage sides, but they aren't glued. The other fuselage side is then laid over the tabs on the bulkheads. After making sure the tabs and notches are seated, the whole assembly is removed from the building board and the ply bottom is positioned. As it snaps into place, the fuselage is automatically squared up, and it can be glued together with CA.

The rear fuselage bottom is then worked into place between the fuselage longerons and glued, and the stab saddle is glued into place, along with the pushrod exit filler. The battery box is assembled and glued against bulkhead F-2, the wing-saddle doublers are glued in, and the fuselage is set aside till later.

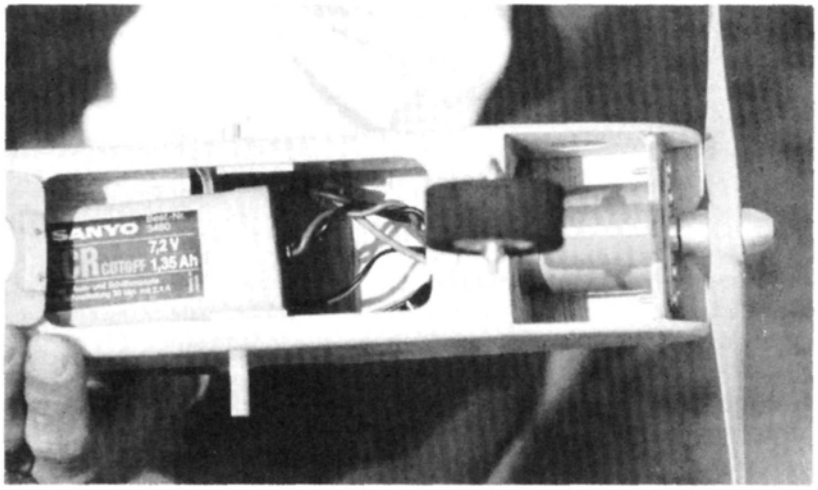
The tail group is framed up directly over the plans. These are simple, built-up, open structures, like those commonly seen on gliders. Both the fixed and moving surfaces are built up to keep the tail end light. After everything has been built, the elevator halves are joined with a wire joiner, and the control horns are mounted.

The rudder, elevator and on/off servo (if you aren't using an electronic speed control) are marked on the supplied plywood servo tray, which is then drilled and glued into the fuselage. After gluing the tray securely into the fuselage, the servos are mounted.

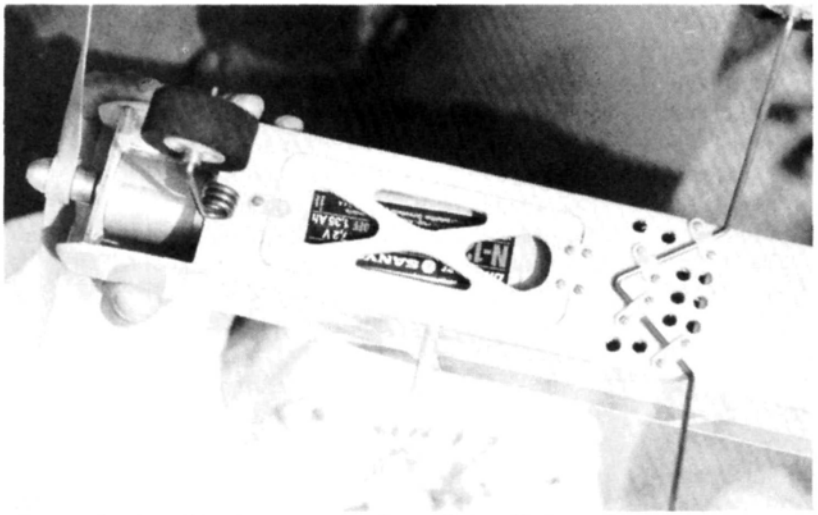
Above: Bare-bones picture shows attention given to keeping the PT-Electric light. Structure is similar to those of a glider or old-timer.



Radio compartment is quite roomy and neat. The open hole is for a motor on/off servo, which was replaced by the Novak speed control.



Access to the flight batteries is very easy through the bottom hatch. Note the stator ring on the motor; it contains the magnetic field and improves motor efficiency.



Battery hatch and landing-gear plate have plenty of holes to keep air flowing over the batteries. Even after long flights at partial throttle, the batteries were only moderately warm on landing.

A small plywood plate is drilled to line up with the motor-mounting holes and the fire wall, and this plate is mounted directly to the motor. The motor is then inserted through the two fire walls, and the plate is screwed to the forward one. This provides a solid mount that allows for easy thrust adjustments and motor access.

The pushrod exits are cut in the rear of the fuselage, and the tail surfaces are tack-glued into place. Very explicit instructions are given for marking and positioning the tail surfaces to ensure that everything is square. The pushrods are wood with wire ends, and Z-bends are used at the servo ends and plastic clevises at the control surfaces. By following the drawings on the plans, all wire bending can be done before the pushrods are fitted. The top front and rear sheeting is then glued to the fuselage, and everything is given a good once-over with sandpaper.

The wing is built directly over the plan; aside from a few small items, it's a conventional structure. There's no leading-edge sheeting; instead, the leading edge is turbulated with 1/8-inch-square balsa sticks. The wing has two 3/16-inch spruce spars that have 1/16-inch balsa shears extending about half the span. Past this point, there are diagonal braces between the spars. I doubt if these actually do anything to strengthen the wing, but they certainly look unique.

The wing is epoxied together at the center, with a plywood dihedral brace and 1/16-inch balsa sheeting on the bottom only. I thought it was rather strange that the top of the wing center was completely open, but, after many flights, I haven't encountered any problems. The instructions call for mounting the tail surfaces before covering, but I strongly recommend that you save this step until after all the covering has been done.

COVERING: I covered the entire model with Super MonoKote*. To save some weight, I could have used one of the low-heat coverings, but I felt that the superior strength of MonoKote was worth an extra ounce or so on an open structure such as this. To show off the PT-Electric's interesting structure, I combined transparent blue with opaque yellow. I trimmed the plane with Goldberg* and Pactra* trim tapes, and the colored lettering was supplied by Mr. Sticker*. The extra work was worthwhile: The finished model was very colorful and has earned many compliments.

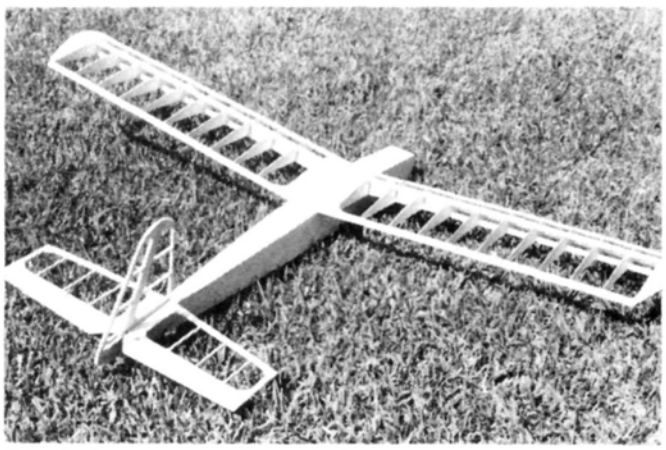
(Continued on page 117)

Basics of Radio

by RANDY RANDOLPH

TEST-FLYING A NEW airplane is always a thrill that never grows old. In fact, the desire to get into that phase of testing is so strong that small mistakes in assembly and construction are often overlooked in the rush to bring that test flight nearer. Everyone knows that poor-fitting joints and sloppy work are bad news, but a lot of times, these are excused in the rush to get the airplane in the air. So let's look at "pre-flight testing" in a slightly different way!

Almost everything we do when building and assembling an airplane is a test. Comparing the size of two pieces of wood or fitting pieces before they're glued into place are two of the most common tests that are performed hundreds of times during construction. Most tests are done without conscious thought, for they have become an automatic part of the overall process of building and flying a new R/C airplane. Therefore, just a few more won't make much difference in time and might save a lot of that commodity later at the field.



It's a lot better to start the pre-flight inspection at this stage of construction, rather than at the field just before the first flight. This ship is the Scrap Stick, designed by John Gill.

As soon as the wing is lifted from the plan and before it's sanded, check for any warps. If there are any, now is the time to get them out. One way to do this is to wet the balsa structure with alcohol from a bottle with a trigger-spray head, then pin the wing down on a flat surface until it's dry.

There's one warp that is good, and it's called "washout." Washout is a condition where the trailing edge is slightly higher than the leading edge at the tip, resulting in a lower angle of attack at the tip than at the root. A small amount of washout in each wing panel is fine *if it's the same in both panels*. This type of warp results in a straight-ahead stall with less tendency to fall off on a wing.

Before any surface is covered, sand everything that will come in contact with the covering material. This is important to help eliminate warps that will creep into the surface when the covering is tightly shrunk. After covering, check for warps once more, and remove them by heating the surface with a heat gun or iron, while holding against the warp. Result: warp-free wings that will contribute to a smooth test flight.

When the fuselage has been framed-up, check to see that it's straight and that the wing saddle and stab mount are at right angles to the fuselage sides and parallel to each other. The easiest way to do this is by laying 3-foot lengths of 1/4-inch balsa across the wing saddle and the stab mount and comparing them to the fuselage sides and to each other. If they aren't square and parallel, this is the best time to make the corrections.

Mount the engine on the fire wall and see that the line of thrust is the same as that shown on the plans. Once more, this is the best time to make any corrections. Metal washers under the engine-mounting lugs or between the fire wall and the engine mount are satisfactory for small corrections, but a flat, true fire wall is the best!

A no-surprises test flight is a very satisfying conclusion to any construction project. The Scrap Stick appeared as a "serial" in the Dallas R/C club newsletter.

When gluing the stab and rudder to the fuselage, make sure they're at right angles to each other and that the stab is firmly in its mount (we know the mount is right because we've already checked it!). Only wood-to-wood joints are acceptable, so peel away any covering material in the glue areas.

Once the airplane is completely covered, and with the fuel tank empty, install the engine, landing gear and wheels, and use the servos, receiver and battery to achieve the balance point shown on the plans. Usually, by placing the battery as far forward as possible, tail-heavy situations can be corrected, but if balance can't be achieved, as a last resort, add weight to the nose or tail until it is.

Check for proper control response when all radio components have been in-

Control

stalled. What I'll describe here applies to Mode II operation. Movement of the right stick backward and forward should move the elevator up and down. Moving that stick to the right should cause the right aileron to go up and the left aileron to go down; left movement should cause the left aileron to go up and the right aileron to go down. If the airplane is a 3-channel bird, the left and right movements should cause the rudder to move left and right instead.

The left stick controls the throttle: forward for high speed and backward for idle. For a 4-channel airplane, left and right rudder is actuated by moving this stick to the left and right. Change sides of the servo output arms with the pushrods until all of these movements are achieved.

Fill the tank with fuel and run the engine several times to establish the proper starting sequence. Hold the airplane at different attitudes and check for proper running. Be sure to check all control responses with the engine at all throttle settings before going to the field.

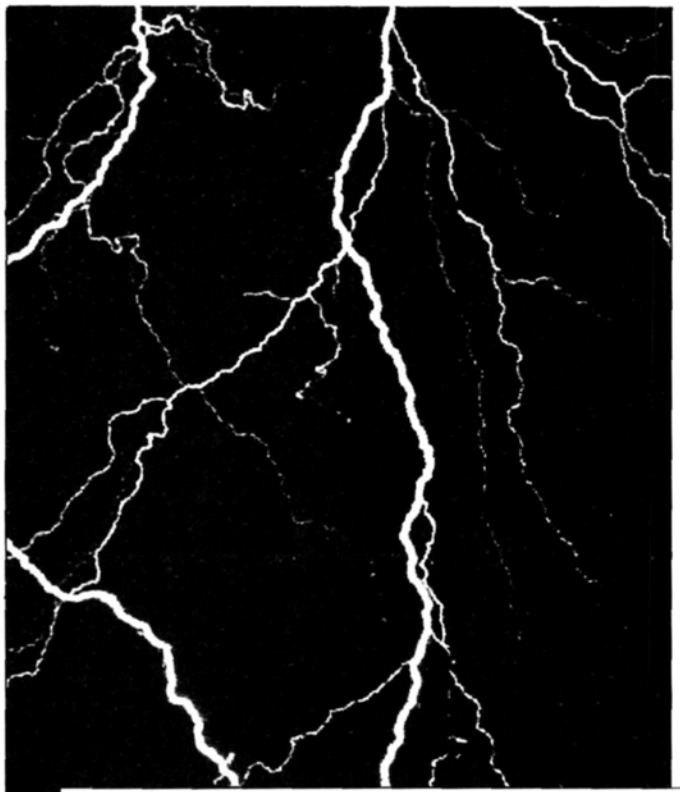
Once at the field, a range check is the only remaining pre-flight test required, for all the rest have been taken care of during construction. The first flight of a properly built and assembled airplane is the best part of R/C modeling. That's basic! ■

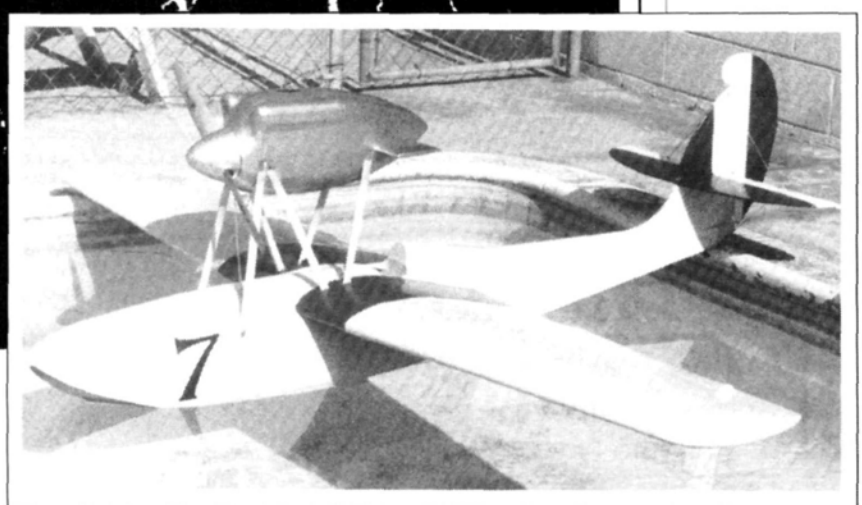
And you thought all battery-powered airplanes were floaters!!

HIGH-POWERED ELECTRICS

by BILL YOUNG

CLOSE YOUR EYES and think of an electric-powered airplane. What picture emerges? A typical view is probably a 3- to 4-foot span, open-structured, gentle, slow-flying stick model. Open your eyes and join me in a look at reality, friends.





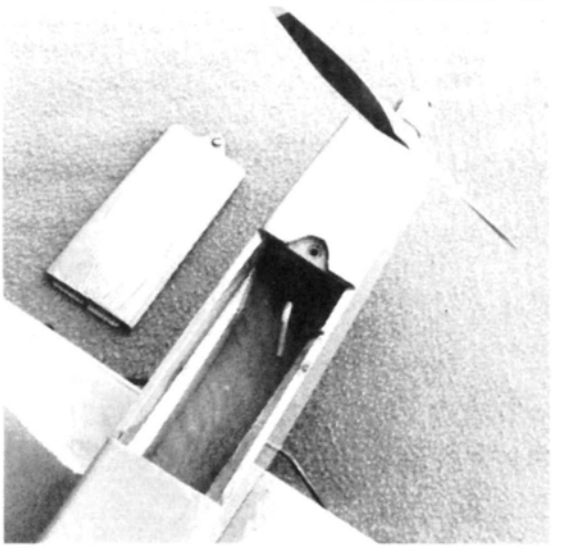
Quarter-scale Macchi M-33 seaplane uses a pair of Cobalt 60s in scale pusher/tractor configuration. Power source? Seventy 1200mAh cells!

PHOTOS BY BILL YOUNG

We're talking high-powered electrics, like a 1/4-scale Stephens Akro with smoke that will easily fly a turnaround pattern; a 112-inch span B-36; a 1/4-scale Macchi M-33 Schneider Cup racer; a 1/4-scale Piper Cub; a Quickie 500 that will do vertical 8s; and a retract-equipped Revenger pattern ship that will fly the full FAI schedule. It's hard to believe that the world record for an electric-powered aircraft is about 160mph when all you usually see flying are an old-timer, a glider with power assist, or some ready-builts that don't fly all that well.

The modeling world as a whole seems to have relegated electric flight to the role of a beginner's plaything with inexpensive motors and small airplanes. Meanwhile, a whole revolution has taken place! The performance aircraft I mentioned were flown with motors and batteries that have been available for at least eight years. To be sure, I'm not talking about inexpensive applications. A Cobalt 40 and the associated batteries, charger, speed control, etc., can set you back $400. Nor am I talking about beginners' models. These are all quite capable performers that demand a knowledge of 4-channel installation and pattern-type flying.

If you aren't comfortable making extensive modifications to a kit or working from scratch, high-performance electrics is *not* the place to begin. You won't find many kits or designs just floating around for this type of application, either. I am, however, currently working with Glen Spickler Radiomodels to make one of its new kits available as a high-performance electric. The resulting model will have 500 square



attery compartment on modified Quickee 500 features uick-release fastener. Pack occupies space formerly taken by fuel tank.

A Quickee 500 with Cobalt 40; power provided by 28 900mAh cells.

inches of wing area and fly with either a Cobalt 25 or Cobalt 40. The performance can best be estimated by noting that the higher-powered version will be able to perform vertical 8s.

The motors and associated equipment for high-powered electrics aren't packaged in a foolproof way, and you'll probably have to make changes here as well. In so doing, you might just feel that the manufacturers could have provided you with a lot more information with which to work. The sources of information are, however, expanding.

The batteries used for high-performance, high-powered electrics are the standard sub-C cells that have been used all along: namely, the Sanyo and the GE temperature-cutoff cells that have low internal resistance and will deliver as much as 50 amps at 1.2V each. The new longer-flight-time Ni-Cds aren't yet widely accepted for our application because they have a higher internal resistance. The motors used to obtain this type of performance are mainly Astro Flight Cobalt motors in 15, 25, 40 and 60 sizes. There are also European Cobalts available, and those from Robbe and Geist are among the more widely used.

Just what kind of power is available? Well, a glow-type 40 racing engine delivers about 1.25bhp to a 9x6 propeller at 20,000rpm. To convert that to an equivalent electric motor, first convert bhp to watts by multiplying by 746 (which gives 932 watts); then adjust upward for the motor efficiency of about 80 percent; indicating a requirement of 1165 watts being fed to an electric motor. Each cell will deliver 1.2V, and the brushes of most Cobalt motors can handle 30 amps. Since watts are equal to volts x amps, it's easy to come up with the need for 28 cells, which a Cobalt 40 can handle by adding an iron ring. The result is the ability to turn the same 9x6 propeller at 18,000rpm. The difference is because the efficiency is actually less than 80 percent. With this power package, a ready-to-fly Quickie 500 will weigh 5.25 pounds, which is only 10 percent heavier than the same airplane with a glow engine installed. The flight time will be about 2.5 minutes, which is long enough to compete in the event. The electric version won't slow down in the turns, and maximum bhp will be available as soon as the throttle is opened.

The power available from an electric motor is limited by the size of the brushes, which, as I said before, is typically 30 amps for Cobalts. (There are other limitations, but in our usage, we aren't likely to exceed those limits). Unlike a gas engine, an electric motor continues to develop more and more hp at lower and lower rpm until, usually, some part of the motor fails. When I observed competitors in a 7-cell glider event, it was apparent that some would climb better than others, and when I looked at their propellers, I knew why. Most were using an 8x5 propeller, which gives a current draw of about 20 amps. The fast climbers were using a 10x5 for a current draw of about 35 amps, and this very nearly doubled the bhp being delivered to the propeller.

The 1/4-scale Stephens Akro I mentioned has been flown to a third-place finish against gas-engine scale models, so why don't we see more of these high power levels in electric aircraft? I think there are two main reasons: The first is that, at these power levels, the flight time is limited to approximately 4.5 to 6 minutes, which, in itself, isn't all that short. I minimize the impact of this by making sure that my battery packs

HIGH-POWERED ELECTRICS

are easy to remove. I land, swap packs, and go back up immediately. Cobalt motors can handle the high temperatures generated by this quick-turnaround use, but care must be exercised because the temperatures of the motor case will give you blisters after two flights in quick succession. When I fly at the same time as others who are flying glow-engine models, I get just as much air time as anyone by using this multiple-battery-pack method.

One key reason for the increase in popularity of these high-powered electric motors is the absence of noise.

The second reason for their (until now) limited acceptance is the issue of weight. Most gas models, especially kits, are much heavier than they really need to be. Owing to the somewhat limited availability of kits specifically designed for electric power, glow-engine-powered kits are frequently selected from a seemingly endless supply, for modification to electric power. This is only natural, but the different design requirements must be recognized and accommodated. For example, airplanes designed for glow or gas power are generally over-built. The logic here is that if an abundance of power is available, target design weights aren't all that important. Strength (resulting in weight) is designed-in to absorb engine vibration. Since that vibration is virtually nonexistent with electrics, structures can be made lighter and just as strong. This should all be part of the modification process. With a properly modified airframe, the weight differences, ready to fly, between electric and glow power shouldn't be all that significant. Granted, our present batteries are rather weighty, but just imagine the potential with some of the experimental cells that weigh a half or three quarters of those we now use!

One key reason for the increase in popularity of these high-powered electric motors is the absence of noise. (I have a 10-percent hearing loss caused by spending years around racing engines.) Quiet electrics can also save flying sites, while still allowing you to fly the kind of airplanes you once powered with gas engines. Modelers in San Jose, CA, have told me that nearly all their gas flying sites have "dried up," and I know of a few modelers there who converted their methanol burners to electric power, while retaining the same levels of performance. When I fly at Sepulveda Basin, most modelers don't realize I'm flying electric (but I *am* quiet!) because my models perform just as well as theirs do! If they notice me, they invariably want to know what kind of muffler I use!

Here are some the basic guidelines for successful electric flying:

- The motor and batteries should be the same weight as the airframe and the radio.
- Static current draw should be 30 amps.
- Use cobalt motor(s).
- Use high-rate sub-C cells (SCRs), not the new, longer-running sub-C cells (SCEs).
- The larger the airplane, the better the power-to-weight ratio and wing loading, and the better it will fly.

My Quickie 500 has 500 square inches of wing area, and the battery/motor compartment weight (49 ounces) equals that of the airframe. With a Cobalt 40 and 18 cells, the wing loading is a modest 28 ounces to the square foot, and the airplane flies well with a 9x7 or 10x6 prop. It's one of very few kits that can be built in nearly stock form for conversion to electric power. My only modification was to add 1 inch to the nose to accommodate the motor. The Cobalt 40, like any electric motor, can be, and is, used at many different power levels equally well. The only difference will be a slight reduction in efficiency as you move away from the peak efficiency point. For example, I use the Cobalt 40 motor at the following range of power levels and still remain within 10 percent of peak efficiency:

- 12 cells at 30 amps = 432 watts with a 13x8 prop
- 18 cells at 30 amps = 648 watts with a 9x7 prop
- 24 cells at 30 amps = 864 watts with a 9x6 prop
- 28 cells at 35 amps = 1176 watts with a 9x6 prop

Although this motor would be rated at 600 watts, because that's the maximum

(Continued on page 118)

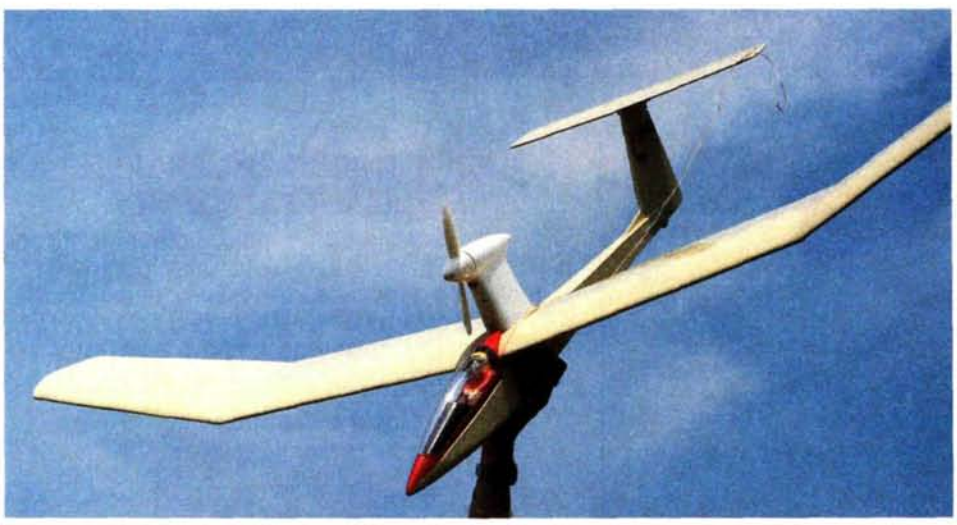
CGM SOPHISTICATED LADY

by ART SCHROEDER

Goldberg's slippery-looking sailplane becomes self-sufficient with a power pod

THIS VERY APPEALING 2-meter glider is one of a series of Carl Goldberg* Models that all utilize essentially the same wing planform and airfoil. The first was, of course, the Gentle Lady, and this newest Lady goes a few steps further with a sleek fuselage/canopy and nifty T-tail.

THE KIT: The kit is complete, needing only covering material, adhesives and radio unit. All hardware is included, as are very good die-cut balsa, lite-ply and birch



PHOTOS BY A. GRAY BUDELMAN

READER REPORT

by ED GOSSERT
Rosamond, CA

SO YOU'VE MASTERED and worn out your boxy trainer sailplane. Are you thinking of something sleeker, but can't quite justify the high price of a fiberglass job? Or you don't think you can handle the higher performance and complexity of a scale model, but you want something that looks like a real sailplane? Or maybe you just want something new, but easy and fast to build, that *doesn't* look like a box with wings. Well, friend, the Goldberg Sophisticated Lady is your bird! It isn't just a Gentle Lady with a nose job, either. They've taken the airfoil and wing planform from the Gentle Lady, beefed up the structure and combined it with a completely new fuselage, then added nice touches, e.g., die-cut jigs and clamps to make wing assembly almost foolproof, a complete hardware package, a full-size plan sheet and an excellent instruction manual.

The kit was well-packed with sticks and die-cut sheets bundled together according to sub-assembly. The quality of the materials is very good: The balsa is smooth and straight; die-cutting is excellent; and many of the parts just fall out of the sheet. The rest are easy to punch out and are very clean, needing little sanding to obtain smooth edges. I really like the combination inventory list/order form.

The first instruction in the building manual is to take inventory of the kit. If anything is missing or damaged, it can be noted on this form; return the form to the factory, and Goldberg will ship the right parts. I had a few problems with my kit, and it took about a week and a half for replacement parts to arrive—free! This is one of many nice touches in this kit.

I can't say enough complimentary things about the instruction manual. A complete list of materials and tools needed to complete the kit is given, then a brief section is devoted to selecting radio equipment. Adhesives are discussed and, of course, Goldberg recommends its Super Jet glue, which is what I used. Next, a paragraph is devoted to general techniques to use in the construction and finishing of the model. Finally, you're advised to read the instruction manual completely before starting. Construction starts with the horizontal stabilizer, vertical fin and rudder.

The wing design is identical to the Electra's, and this new wing structure is much stiffer than the Gentle Lady wing. During even mild, high-start launches, you can see the Gentle Lady's wings flexing, and I'm sure an aggressive winch or a strong high-start could snap a Gentle Lady wing. There's no danger of this happening with the Sophisticated Lady.

I liked the supplied die-cut, lite-ply "clamps" and dihedral gauges. These provide just the right amount of pressure at the proper spots to ensure correct installation of the ply panels on each side. (There's nothing worse than a polyhedral wing with different angles on each side!) Also detailed in the instruction manual is an optional three-piece wing (detachable tip panels). The fit of the die-cut parts is excellent.

I found a few weak spots in the fuselage design. The top and bottom sheeting on the aft fuselage is die-cut 1/16-inch sheet with the grain running lengthwise! This makes the fuselage a little weak in compression back there. A little too much squeeze when getting ready to launch could crack the top or bottom sheeting. (I speak from experience. My Gentle Lady had the same type of construction.) My solution? I added cross-bracing made of leftover 1/8-inch-square stock in three places on the top and three on the bottom. I installed the top sheeting first, as the book instructs. This establishes the shape of the rear fuselage. Then I put the cross-braces in, top first, then bottom; next, the bottom sheeting is glued into place. This will make the aft fuselage much more resistant to a too-firm launching grasp. (I got this idea from the *MAN* review of the Electra last year. Thanks!)

The other problem is the fuselage bulkheads: They're 1/16-inch die-cut balsa, with a die-cut brace glued to the bottom of each. These are *very* fragile during initial installation in the fuselage, and the dihedral angle of the bottom of the wing is *not* cut into the top of the bulkheads! I didn't discover this until the aircraft had been assembled, and I tried to put the wing on to see how it would look. The wing wouldn't seat! I had to carve relief for the wing after the airplane had been built, and it wasn't much fun. I suggest that you cut this angle *before* assembly.

Final assembly goes smoothly after covering. I covered my Sophie with metallic charcoal and aluminum Super MonoKote with red trim tape on the seams. I installed my Aristo-Craft 4000 radio system and found adequate, but not excessive, room, so I'm sure any currently available flight system will fit with no problem.

My Sophisticated Lady weighs 30 ounces, ready to fly. I figured it would be like a Gentle Lady, but prettier—boy, was I surprised! After a few hand-tosses to make sure nothing was seriously wrong, we stretched the high-start.

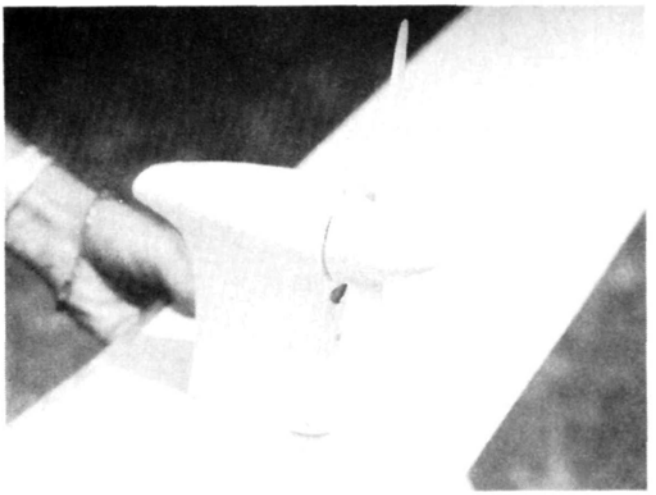
The first launch was as straight as an arrow, and then the differences started to show. Sophie definitely seemed faster, and the turn response was fantastic! At slow speed, my Gentle Lady gets a little sloppy, and there's some lag between stick movement and the actual start of a turn. Not so with the Sophie! You move the stick; it turns! It seems to have a better L/D than the Gentle Lady, too. Perhaps less drag from the new fuselage and more efficiency from the sheeted leading edge?

Sophie thermals *really* well! My longest flight to date has been just over half an hour, in mild Southern California winter conditions! Wait till this summer! I'm sure that with some weight in its belly, it could handle moderate wind well, and I can't wait to try it out on the slope—and it looks great! It's a blast just to make a long gentle dive to pick up speed, then pull up in a tight sweeping turn over my head and admire the curve of the fuselage, the upsweep of the wings, and the T-tail. Try it—you'll like it!

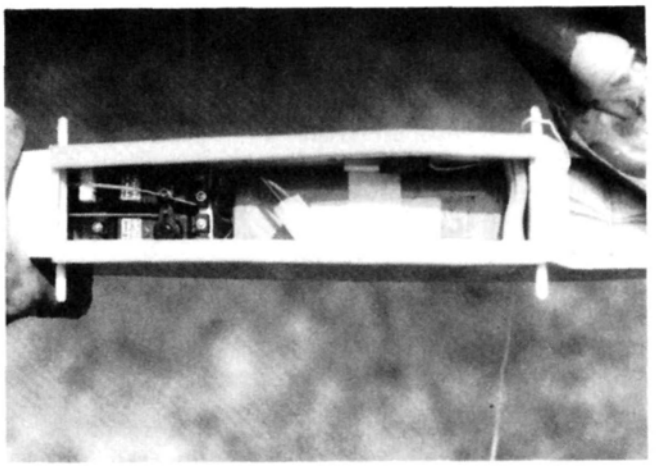
My conclusion? Carl Goldberg Models has another winner! Sophie is worth the small amount of extra effort required. Take your time, follow the directions, and you'll have a ship every bit as sleek as the "glass slippers" that cost about four times as much! ■

SPECIFICATIONS

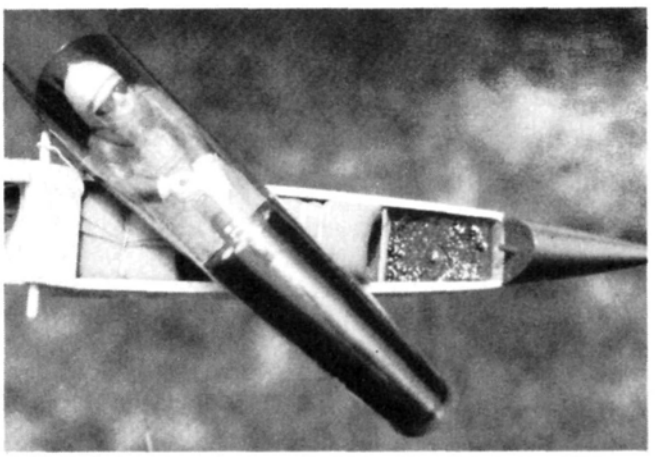
Type: *2-meter glider for high-start, winch, or optional power pod*
Span: *78 1/4 inches*
Length: *43 inches*
Design Weight: *25 to 29 ounces (without power pod)*
Review Aircraft Weight: *50 ounces (with power pod and battery pack)*
Area: *663 square inches*
Wing Loading (as reviewed): *10.86 ounces per square foot*
Power Req'd: *Optional power pod*
No. of Channels Req'd: *2*
Suggested Retail Price: *$49.95*
Features: *Built-up balsa and lite-ply structure; excellent construction manual; full-size drawings.*
Comments: *A 2-meter glider that has it all: simple, but rugged, construction; snappy lines; easily converted to electric or glow power; relatively easy to fly, while providing excellent soaring*



Power-pod installation adds to the flexibility of the Sophisticated Lady; eliminates requirement for winches or high-starts.



Wing is removed to show installation of two servos and Velcro hold-down for 7.2V Ni-Cd pack used for motor power. Radio system uses its own dedicated standard battery; doesn't draw from propulsion battery.



Canopy section forms removable hatch to provide access to radio compartment. Ballast occupies most forward section.

plywood parts, a set of excellent plans and an instruction booklet that's accurate in description and sequence (a truly superior construction outline).

The parts fit was most satisfactory; only a little re-notching was needed on the spar slots of a few ribs. With the notable exception of some granite-like blocks included for the wing tips and nose cone, the wood was also satisfactory. The very hard, straight-grained fuselage sides were a real plus, and I really appreciated them.

CONSTRUCTION: Sophisticated Lady uses a sheet box construction for its fuselage, open-stick framework for the tail feathers and dual spar, and a built-up, sheeted leading-edge format for the wing. Nothing in the building sequence should cause any problems, even for the most inexperienced builder.

Because I intended to use the optional electric power pod, I planned the construction from the start with that unit in mind. Looking at the plans, it became apparent that the powerplant battery was in an awkward position relative to pushrods. So, too, most of the battery's bulk (and weight) was aft of the CG. I improved this by placing the battery forward of the servos, which were relocated to the rear of the radio compartment. Indeed, even with a large 1200mAh battery, just a small amount of lead shot in the nose brought things into perfect balance.

The entire model was built with Super Jet thin and medium-viscosity CA (about 1 1/2 ounces were needed). I had forgotten that wax paper is a better plan protector than Saran Wrap when using CAs. I used the Saran Wrap and had a devil of a time sanding off all the plastic that stuck to the wing framework. Use *wax* paper!

Instructions are so well-done that I'd be hard-pressed to offer any additional suggestions, with the exception of two notable areas. The instructions led me to believe that the dihedral and polyhedral joints could be satisfactorily made without cutting appropriate angles on the spars and that the spar joiners were sufficiently strong. I *did* bevel the joints, and I suggest you do the same for maximum strength. A removable tip option is described, but I felt the reduction in size wasn't sufficient to warrant the bother.

In the fuselage sequence, the fuselage is completely

enclosed before the fin and its flexible-cable elevator pushrod are installed. This makes it impossible to tack the cable down every few inches or so—a very necessary task, but one not mentioned in the instruction booklet. Without securing the cable's outer sheath, the elevator control would be much less effective owing to movement of the entire assembly. This is easily solved by installing the rear 5 inches of the fuselage bottom and all forward sheeting to the back of the radio compartment. When the vertical stab has been installed and the cable tacked down in a couple of places, the bottom sheeting can be finished. I found it helpful to lubricate the cable with a little petroleum jelly for the lowest possible elevator-system drag.

The wing center section was prepared for the electric pod before the center-section top sheeting was applied. This permitted a very neat sheeting to the pod's pylon and a more secure arrangement than a retrofit job would allow.

Instructions warn you to be most careful when installing the canopy on its balsa base to avoid warping it. I guess I *wasn't* careful, because I ended up with a compound curve of the base that required the application of balsa strips to eliminate the unsightly *gaps* that appeared! I suggest that you *don't* repeat my mistake.

Tail construction was very straightforward, but be sure you make very good joints, since the structure is relatively light and easily warped.

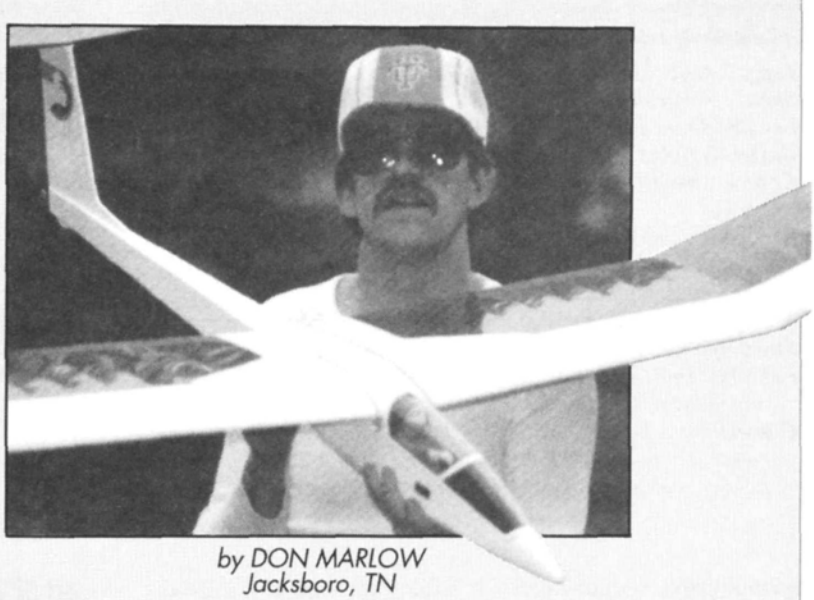
When sheeting the wing leading edge, get the sheeting as flush as possible with the leading edge to avoid having to do too much sanding. You're only working with 1/16-inch balsa, and it doesn't take much to sand right through this light stock.

The extremely hard wing tips were a nightmare to carve since they're attached to a very light structure, and it was difficult to put any *real* pressure on my carving blade. Patience and my trusty rasp file prevailed, however, and I now have very "ding-re-

(Continued on page 128)

CGM SOPHISTICATED LADY

READER REPORT



by DON MARLOW
Jacksboro, TN

I'VE BEEN LEARNING about R/C for a year. My first kit was a Great Planes Trainer Forty, which I built and flew briefly without any assistance. The plane survived, but I quickly found that, without help, I needed something slower with which to learn. The Forty was temporarily retired until I learned to fly with a Dynaflite Piece o' Cake, which, after a few rebuilds, was just what the doctor ordered. I learned the importance of balance, weight, and how to turn left and right in the air. I also decided I liked the quiet part of its flight, so I began looking for a glider kit. The Sophisticated Lady, with its T-tail, sharp looks and optional electric power pod, was my choice, and a friend chose the Gentle Lady.

The kit and instructions were excellent. The instruction booklet even included a section on soaring techniques, and to my limited experience, the wood selection seemed good. All the parts fit well and the hardware was excellent. Wing construction went very smoothly, and clamps and jigs were included. Compared with my friend's Gentle Lady, the additional wing sheeting seemed to add strength as well as a pleasing appearance. A very nice touch is the thin, sheet aluminum used to protect the trailing edge from being damaged by the rubber bands.

Fuselage and T-tail construction are very simple and seemed sturdy for a glider. The solid nose block and doublers added considerable strength. I encountered two problems during construction: One involved keeping the cowl/cockpit assembly flat while putting the balsa on its bottom (the instructions do mention it, but I overlooked that line); the other involved anchoring the plastic tubing for the elevator cable. The instructions didn't mention the need for anchoring during fuselage construction, so it was accomplished with some difficulty after the plane had been covered. The plane was completed with a Futaba radio, standard servos and a modified battery pack (the flat pack wouldn't fit). Covered with Black Baron white and transparent blue, the plane looked great.

Flight testing revealed a problem with the T-tail. Landing with one wing slightly low caused the plane to spin. Even a slight twist or spinning motion puts a heavy load on the tail—sort of like cracking a whip. The third test-glide ended with a broken fin where the horizontal stab attaches. After repair, the plane was successfully flown from a high-start. Flying was easy: It turns very slow and wide with a delicate touch on elevator.

The tail continues to be a problem for an amateur, and it had to be repaired after each flying session. Finally, I chopped it off and lowered it to a Gentle Lady configuration, and this has worked fine for me. I attribute the problem with the tail to my lack of flying skill, not to any deficiency of design. Although it doesn't look as spiffy as it did in its original configuration, I'm still pleased with the plane. I have a video of it flying with the T-tail and am considering adding the power pod. ■

GREAT PLANES ELECTRO STREAK

by RALPH CLOUD

THE GREAT PLANES* ElectroStreak caught my eye when I first saw the advertisements. I thought, "Now here's an electric that will make people sit up and take notice." I've had to defend the potential of electric-powered aircraft too many times. Most modelers seem to think that electrics are just powered sailplanes and dismiss them as boring, but the ElectroStreak was designed to dispel that myth. The advertising boasts that the plane is capable of performing basic pattern-type maneuvers—including Cuban-8s and snap rolls. After building and flying the ElectroStreak, which was originally designed by Tom Stryker, it doesn't *look* docile, nor do I expect it to fly like a slow sailplane.

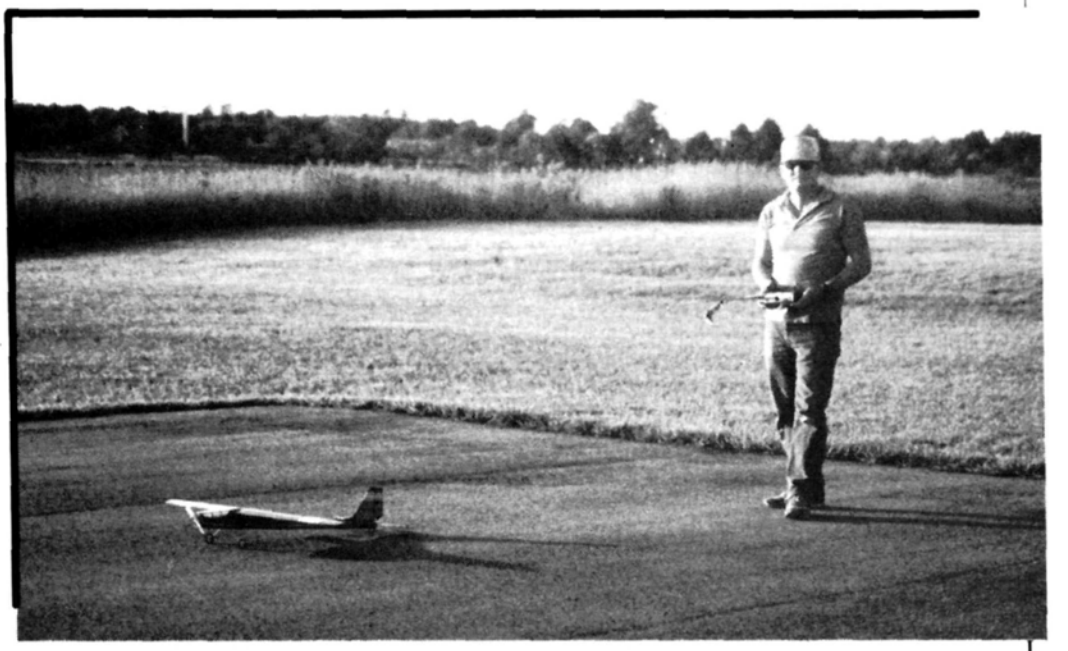
THE KIT: This project starts like any other: Open the box and sort through the contents with much anticipation of the things to come. The quality of the wood was excellent; owing to the need for a light structure, it was light, yet strong. The balsa leading and trailing edges had been pre-shaped and notched. Die-cutting was excellent and, from the 1/16-inch ribs to the 1/8-inch ply, the parts fell right out. To prevent the motor or hardware from damaging the balsa, the con-

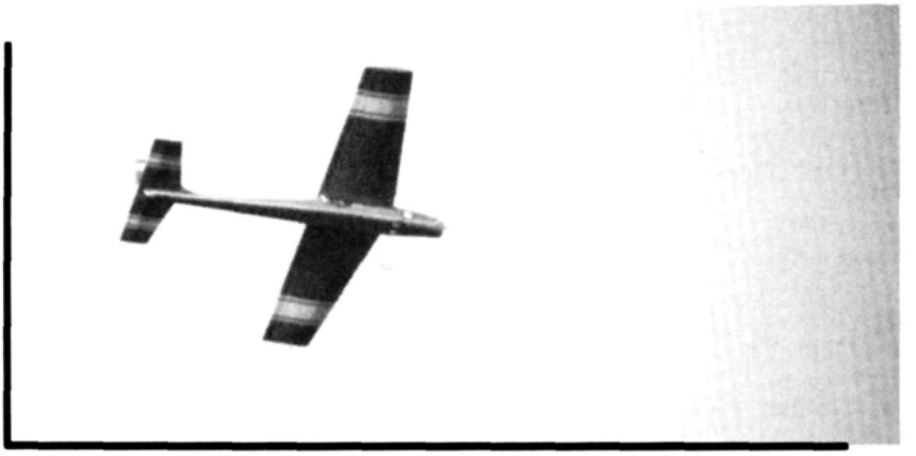
Appropriately named, this electric delivers performance!

tents were well-packed. The Goldfire motor and capacitor were packed in a box that was glued to the bottom of the carton at one end, and this prevented it from shifting and causing damage. The black-and-white plans are printed on one sheet of 33x48-inch paper.

The hardware package was complete, including push-rods, control horns, clevises, strip hinge, prop adapter, prop, Allen wrenches for the prop adapter and spinner, landing-gear wires and mounting straps. The rudder is designed for a pull-pull control; needless to say, the plastic-coated steel cable and the crimp fittings were also included. To connect the pushrod and cables to the servos, E-Z connectors were provided for the cable; setscrews were substituted for the normal slotted screw. Fiberglass tape for the wing center was provided, as well as Velcro for attaching the various radio parts (details later).

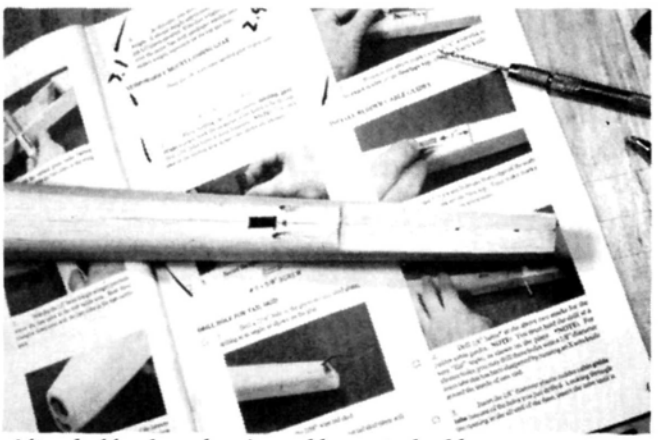
The 40-page instruction book lists items that aren't included in the kit (radio, speed control or switch, batteries, wheels, iron-on covering and foam wing-seating tape); however, it fails to mention anything about the motor wiring harness, which isn't provided. Not much is left out!



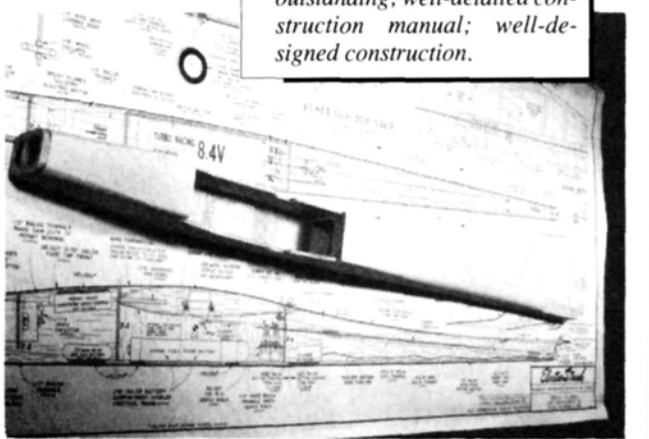


SPECIFICATIONS

Type: *Intermediate sport*
Wingspan: *44 inches*
Length: *39.5 inches*
Weight: *Design: 42.3 ounces with optional wheels*
Actual: 42.8 ounces
Area: *340 square inches*
Wing Loading: *18.4 ounces per square foot at 42.8 ounces*
Power Req'd: *Goldfire motor (included); 7-cell battery pack (not included)*
Channels Req'd: *4 (aileron, elevator, rudder and speed controller)*
Suggested Retail Price: *$74.95*
Features: *Precision-cut balsa and ply parts; pre-bent custom landing gear; prop and custom prop adapter; all special hardware; full-size rolled plans; step-by-step photo-illustrated instructions.*
Comments: *Quality of wood is outstanding; well-detailed construction manual; well-designed construction.*



Aft end of fuselage showing rudder control cable outlets and stabilizer platform. Note the photo-illustrated construction manual.



The completed fuselage after sanding, prior to covering. Plans are well-detailed.

GP ELECTRO STREAK

by FLOYD MANLY

"WHILE NOT a beginner's plane, the ElectroStreak is great for the intermediate or advanced flier who wants real performance with the quiet convenience of electric power."

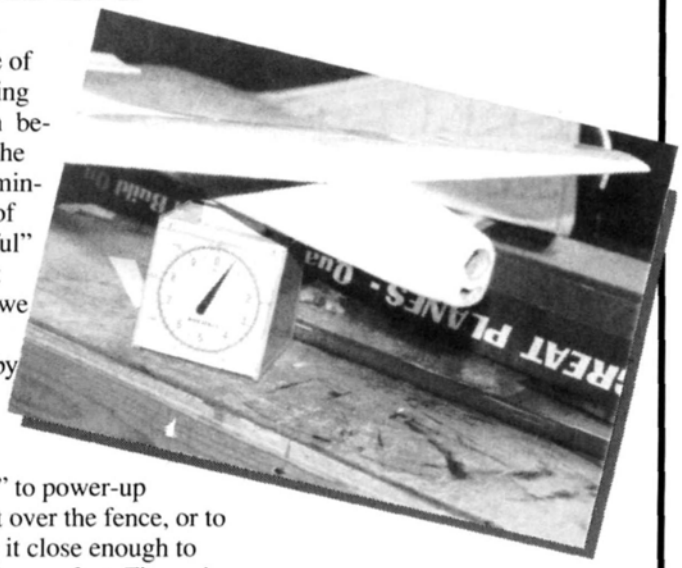
These words are tucked neatly into a corner of page two of the ElectroStreak's instruction booklet; they *should* be printed in big, bold, letters on the cover of the box! As they say on TV, "This is not your father's Oldsmobile"—and the ElectroStreak is *not* a beginner's aircraft! With these few words of caution, let's take a look at what the ElectroStreak *is* and what it includes.

THE KIT: When the box is opened, the most striking thing is the *very small* pile of wood and the *very large* instruction booklet, which has over 140 photos and sketches showing every imaginable detail: assembly, cover, ground check, pre-flight, range check, test hop, fly, post-flight, etc. Whoever wrote the book was probably being paid by the *word*, and in typical Great Planes fashion, *everything* was discussed thoroughly.

PERFORMANCE: The ElectroStreak is a performance-designed aircraft, and this is just what you'd expect from Great Planes. To get it into the air, however, you'll have to perform a little yourself, as it takes a pretty good launch to get it moving fast enough for its semi-symmetrical wing to start flying. My first attempts were nothing to brag about, and the less said about them, the better. After pulling the landing gear back off, removing 4 ounces of in-flight batteries and a 1-ounce switch, and installing a Futaba MC 112B FET motor control with BEC (Battery Eliminator Circuitry), we got it to fly—and it flew beautifully! Fortunately, I enlisted the aid of a fellow who was a couple of years younger than my 59. He could get moving and really chuck that devil out there. The ElectroStreak isn't a floater and has to be spear-tossed! Otherwise, it will just settle with a crunch back onto the turf. Forget up-elevator; it only invites a snap roll—as well as some harsh words!

When it was airborne for the first time, with the trims worked in, it really sang! There was some breath-holding during the first five seconds of each flight, though, until the Goldfire motor and seven Sub-C cells got up a "head of steam." It accelerates slowly, but moves out smartly after a while. It was a pleasure to listen to the remarks of the spectators and the other fliers: "Hey, that thing's *fast!*"..."Look at it go!"..."Rolls?—with an *electric?*"..."Inverted flight?"—and so on. But I'd prefer to trade off some speed for more low-end power.

Keep the aircraft in close, because when the power runs down, it's ready to land immediately. With the electronic throttle, I used the technique of shutting down before the five minutes of "useful" flight time we had, thereby saving a little "fuel" to power-up to get over the fence, or to bring it close enough to land by my feet. Five-minute flights with the ElectroStreak are long enough. You won't sit back and let *this* electric just cruise or glide around—you'll be knocking clouds out of the sky!



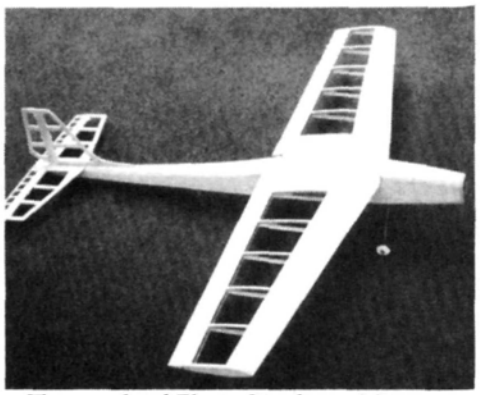
Update, Update!

After 20 to 25 flights, we started experimenting with different props and battery combinations to get the most power and longest duration (another story!). A dramatic increase in power came when we installed a Master Airscrew 7x6 glass prop! No spinner, and we had to use a bushing made of Nyrod pushrod to fit the prop to the stock shaft. We did this out at the field, and the increase in performance was so significant that I think it merits a mention here.

With the new prop, the ElectroStreak almost jumped out of the launcher's hand! *Now* we had a performer that had people gathering around to see what we had done. Later that day, I ran a couple of checks on my thrustometer to verify the field results. Would you believe that the Master Airscrew 7x6 prop showed *a 1/4 pound* more thrust than the Grish Tornado white nylon 7x6 prop that's included in the kit? We later tried a Graupner 7.25 folding prop, and it, too, performed better than that wimpy thing that I got for free—though not as well as the MA prop.

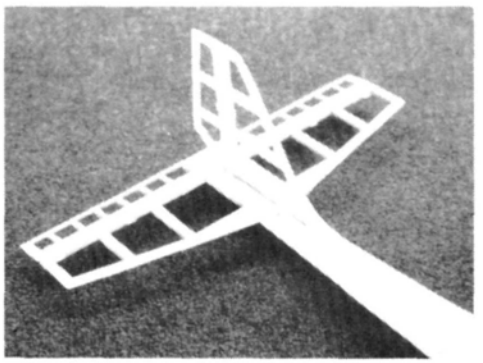
I'm no longer just *happy* with my ElectricStreak, I'm *delighted!* In fact, I was so impressed, I've already started to build another one in an attempt to convert my brother to electric.

ELECTROSTREAK



The completed ElectroStreak awaiting covering. Attention to weight conservation is evident.

To provide an airframe that's as light as possible, the ElectroStreak's construction is of balsa and ply. Before beginning construction, read through the instruction book to become familiar with construction sequence. There's a great deal of information about selection of radio and adhesives, along with cautions to keep the airplane light. During the building process, I got a little carried away with a digital scale that I borrowed from a friend; I even used it to match the weight of the spars and sheeting for the wing to laterally balance the wing during construction! Anyway, either a digital scale or just a



Tail feathers use simple, lightweight construction; even the elevator is built-up.

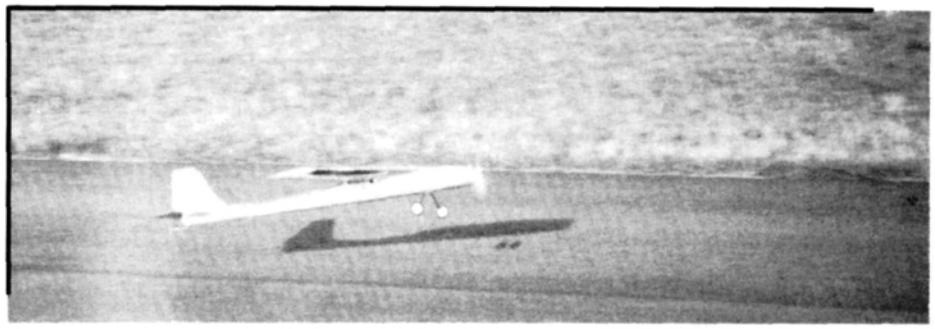
simple spring-style dieter's scale is helpful.

To hold all the quality wood together, I tried a new product from Satellite City*. Although I'm sensitive to the fumes associated with the use of most CAs, I do enjoy the advantages of this type of glue. UFO (User Friendly Odorless) has the same characteristics as CAs, but without the fumes. It proved to be an excellent glue without the headache (and I *do* mean headache!).

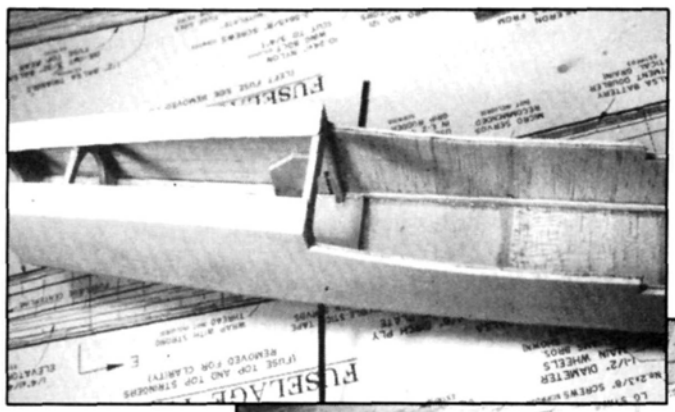
CONSTRUCTION: The instruction

(Continued on page 50)

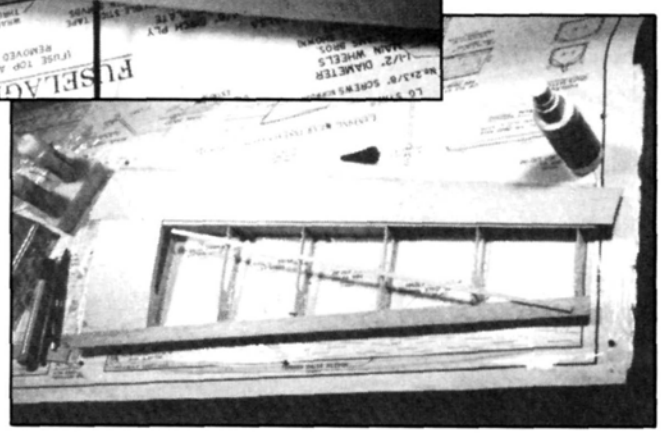
ELECTROSTREAK



book has a box by each step, so you can keep track of progress. The first section directs you to examine the contents of the box, unroll the plans so that they lie flat, and identify the die-cut parts. The one fault in the entire construction sequence was at this point: The names of the front and rear landing-gear doublers are reversed on the die-pattern drawings (i.e., the front is the rear and the rear is the front). After this has been corrected, you can start construction of the fuselage.



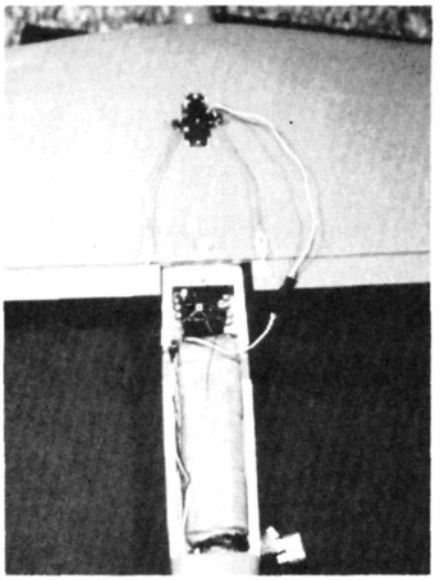
Left: Landing-gear vertical legs are held in position by hardwood blocks and ply scabs on interior wall of fuselage. Lack of vibration with electrics allows lightweight structure.



Right: The wing panel is built directly over the plans. It's shown here just prior to the addition of rib capstrips.

Begin by joining the front and rear fuse side halves, label each half, and mark the location of the formers. Glue the stringers, landing-gear doublers and the triangular corner stock on the top rear fuse and the top and bottom of the fuse front. Glue the vertical-grain battery-compartment doublers into place. Trim the top triangular stock at the rear of the fuse; glue formers F-3 and F-4 into place; then join the fuse sides, ensuring that alignment is maintained so you end up with a straight solid fuse. Trial-fit the motor in F-2, drill holes in F-l, and trial-fit the motor by attaching it to F-l and F-2. Slip the motor into the fuse nose, trim as necessary for a tight fit; glue F-l and F-2 into place; and remove the motor. Glue the fuse rear together; add cross-grain bottom sheeting; install the landing-gear top plate with the front and rear doublers properly installed. Sheet the fuse front top and rear top with pre-cut balsa sheeting. Laminate the balsa-ply nose block from the die-cut pieces, with alternating grain, and glue it into place on F-l. Sand the fuse to a rounded shape, as shown in the cross sections on the plans. It sounds complicated, but it really was easy.

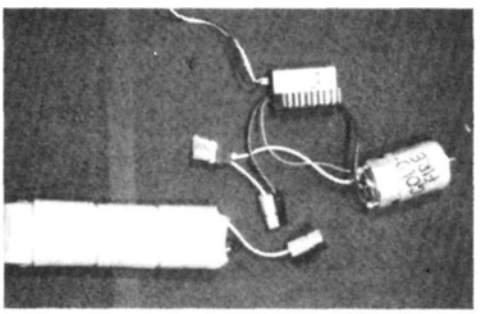
The instruction book claims that, at this point, the fuse should weigh 2.5 ounces. Mine weighed 3.3, so I sanded off some more balsa: It takes a lot of sanding to take off half an ounce! After nearly sanding *through* some of the sheeting, I managed to get the weight down to 3.1 ounces. As it was a rather humid day, it occurred to me that the fuselage might be lighter if it



Equipment compartment isn't spacious, but it's adequate to house a 7-cell pack, as shown. Wing is shown resting on aft fuselage, creating the impression that the battery is behind the wing—obviously not the case!

were dryer. After placing it on the oven door with the oven on for 15 minutes, the weight was down to 2.9 ounces—close enough!

The next steps require pre-installation of the servos for the servo-rail location and the wing plate (which will be drilled and taped for the wing hold-down screw). An additional note: The instructions *recommend* micro servos, but these are *a must*. If you use anything larger than micro servos, *they will not fit*—believe me!



Propulsion package includes 7-cell Ni-Cd pack, supplied Goldfire motor, and electronic speed controller, which replaces on-off switch.

The built-up fin, rudder, stab and elevator are constructed next. The main material is $^3/_{16}$x$^3/_8$-inch balsa, and this builds into a strong, yet light, structure. The hinge strip is prepared next by sanding both sides with 220-grit sandpaper, marking $^3/_8$-inch width, drilling two $^1/_{16}$-inch holes between the marks and then cutting the balsa into strips. These hinges

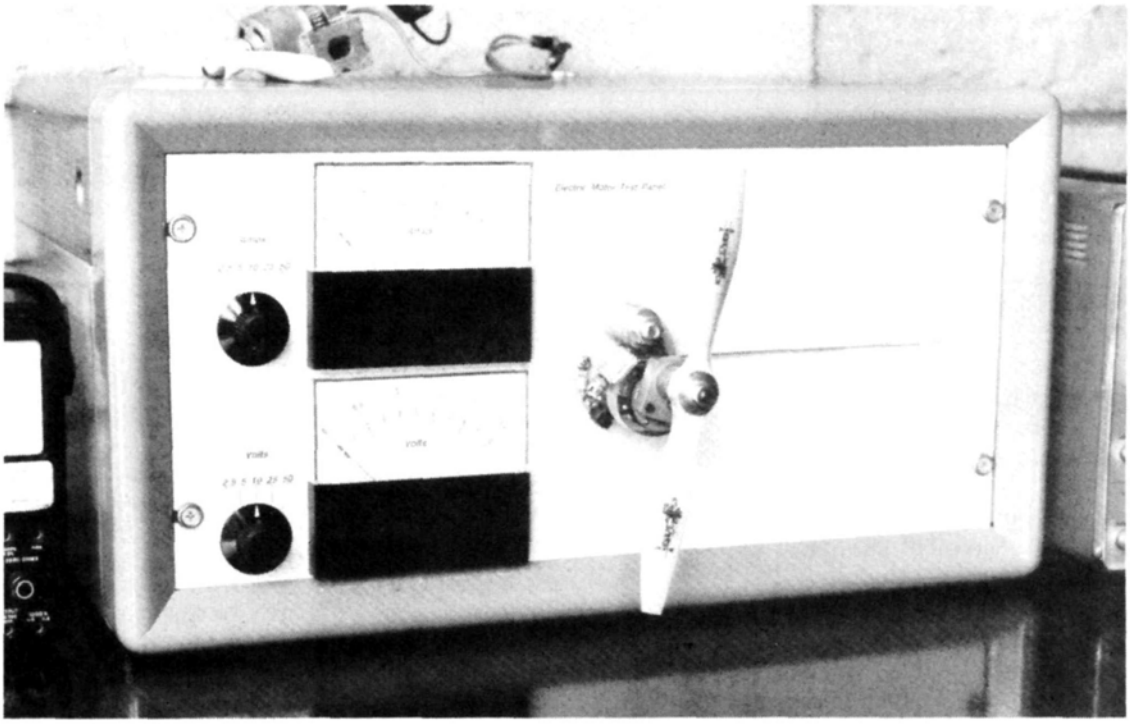
(Continued on page 130)

Build An Electric Motor Test Panel

PART 1

by IVAN C. MEEK

Exploring an accurate means of measuring motor performance

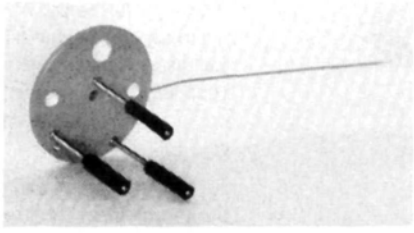


A cabinet looks nice, but a simple box will serve the purpose just as well.

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind..."

—Lord Kelvin

YOU MUST HAVE SEEN the advertisements for motors: "extra-hot power," "ultra-high speed," "hyper-power," "hyper-acceleration," "hyper-speed." Hyper-hype! In Lord Kelvin's words, this advertising is "knowledge of a meager and unsatisfactory kind." The quality and performance of these model motors varies widely, yet there's no industry-standard rating system. Unfortunately, most motor manufacturers don't supply enough technical information to evaluate their products, and the magazines, likewise, don't contain quantitative evaluations. We need, as engineers say, "the numbers."



The motor-mounting platform is a 2½-inch gear blank with offset threaded rods for motor support.

Accurately measuring motor parameters at home can be difficult and expensive, requiring load cells, frequency counters and other specialized equipment. This article, (in two parts; the second part to be published next month) describes how to build a simple and inexpensive motor test panel and shows how easy it is to measure motor performance.

The motor voltage and current are required to calculate the electrical power a motor consumes. Likewise, the shaft output speed and torque can be used to calculate the mechanical power the motor produces. By taking a few precautions, voltage and current can be measured with simple meters. Measuring the rotational speed of the output shaft is a little more difficult; measuring motor output torque is a *challenge*.

Understanding the principles of operation can be very useful during testing or construction. If equations put you to sleep or give you the creeps, you can skip this section. You don't have to understand the theory to build or to use this motor test panel, but the equations are *very* simple. Power, input or output, electrical or mechani-

cal, linear or rotational is just two variables multiplied. Another multiply or divide if you choose your answer to be in different units. That's all!

Theory of Operation

The power consumed by a DC electric motor is defined by this simple equation:

$$P_{in} = V_{in} \times I,$$

where P_{in} is the power into the motor, in watts; V_{in} is the voltage at the motor terminals, in volts; and I is the current through the motor in amps.

Measuring is simple: Attach a voltmeter across the motor terminals and an ammeter in series with the power source, as shown in Figure 1.

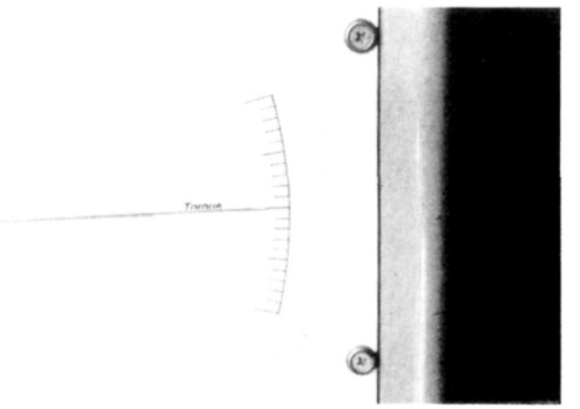
If the current drawn by the motor is constant, and if the resistance of the voltmeter is high, then the accuracy of the measurement is limited only by the accuracy of the meters. If the current through the motor has a large ripple or transient component, especially if the peaks and valleys of the current don't match the peaks and valleys of the voltage, measurement errors can occur. Usually these errors are negligible.

The equation for mechanical power is as simple as the previous equation:

$$P = F \times v$$

where F represents force in the direction of motion and v represents the velocity. (See Figure 2.)

Metric units were chosen for this formula, Newtons for force and meters for distance. Choosing Newtons as a measure of force might seem like intellectual snobbery when good old pounds and ounces are available, but the advantages of metric measurements in this situation are compelling.



Pointer is 1/16-inch aluminum tubing with a household needle glued into the end.

The electrical measurements—volts, amperes and watts—are metric units. What's more, model motor output ratings are commonly given in watts. Input and output power comparisons are simple because both mechanical and electrical metric power units are the same. The metric system avoids all the confusion in Imperial measurements where the term "pounds" is used for both force and mass. One final note about confusing units: Kilograms aren't units of force, and Kg-cm isn't a measure of torque! Please don't import that confusion from the English (Imperial) sytem of measuring!

Mechanical power can also be in the form of a torque that causes a shaft to rotate. This equation is as simple as the others:

$$P = \tau \times \omega$$

where τ represents the torque on the shaft, and ω represents the shaft spin rate.

This equation is the same as the previous one, but the force is applied

Only simple devices are required for parametric measuring

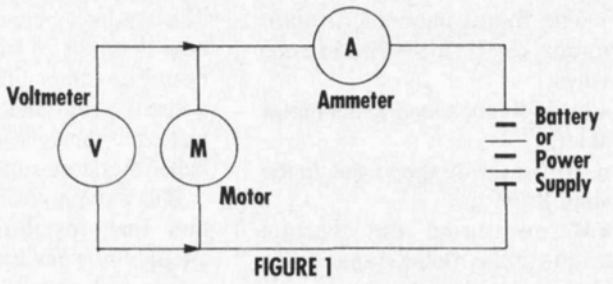


FIGURE 1

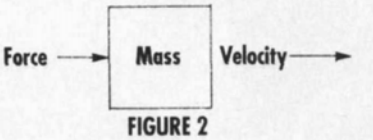


FIGURE 2

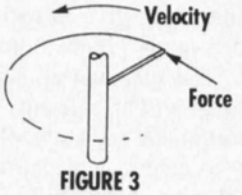


FIGURE 3

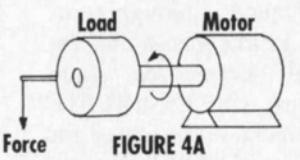


FIGURE 4A

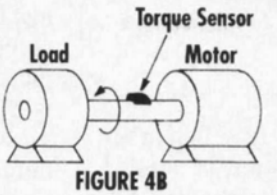


FIGURE 4B

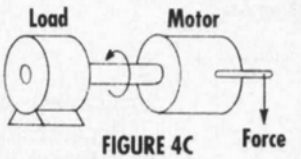
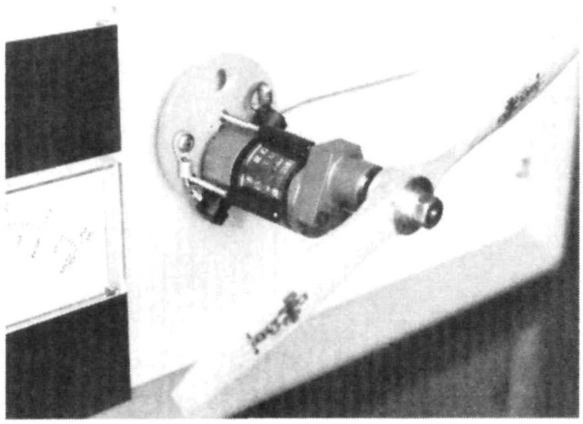
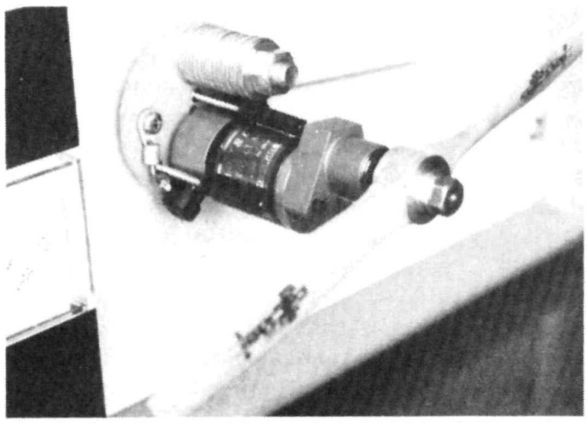


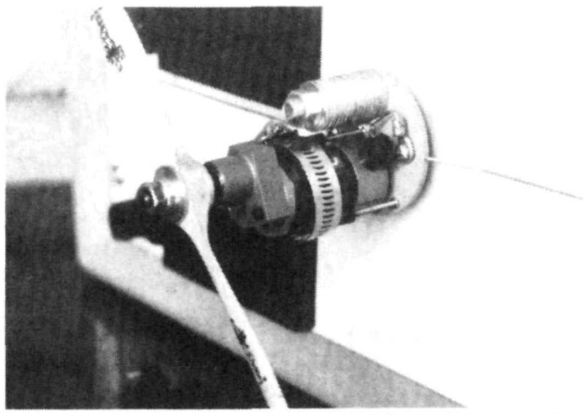
FIGURE 4C



Geared motor thrustline is aligned with the mounting platform rotational axis. Plastic shoulder washers insulate the electrical feed-throughs.



Stack of washers provides a counterweight to balance the assembly.



A hose clamp holds the motor securely to the threaded mounting rods.

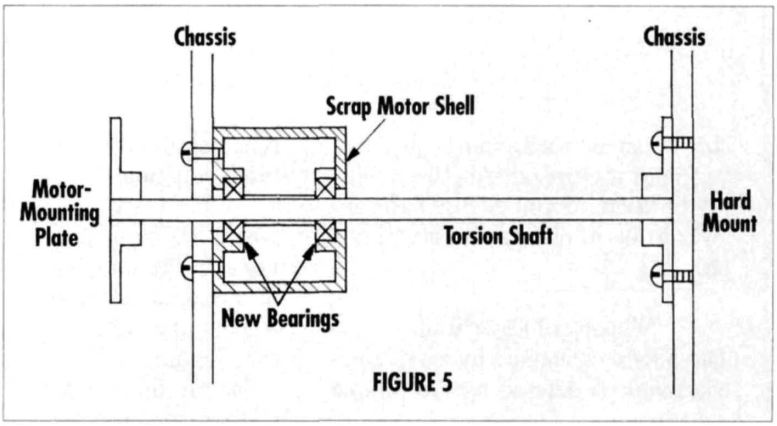


FIGURE 5

in a circular path. (See Figure 3.)

Because the force is applied around the circumference of a circle, 2π becomes part of the equation. Converting from revolutions per second to revolutions per minute, generates an additional factor of 60, so the equation in metric units is:

$$P = \frac{60}{2\pi} \times \tau \times \text{rpm}$$

where τ represents the torque in Newton-meters, and rpm is the shaft spin rate in revolutions per minute.

Since the input and output power are both measured in watts, the efficiency equation is just:

$$\text{Eff.} = (P_{out} / P_{in}) \times 100\%$$

Design of a Motor Test Stand

Output power measurement requires sensors to measure the actual torque and spin rate of the shaft. A standard model airplane photoelectric digital tachometer can be used to measure motor rpm.

The fourth parameter, motor torque, can be measured in three ways:

- by applying a load to the motor shaft,
- by measuring the torque in the shaft itself, or
- by measuring the reaction torque at the motor frame. (See Figures 4a, 4b and 4c.)

The first technique doesn't allow for loads like propellers. The second method, although common in industrial measurements, is difficult because the torque sensor spins with the shaft. The third technique is the easiest for us, but a special effort is required to keep error torques low. Error torques are caused by friction in the mounting bearings and nonlinear mechanical stresses within the motor electrical connections.

Construction

The motor is attached to a limited rotation platform, and the platform, in turn, is mounted on a low-friction bearing. The platform rotation is constrained by the torque-measuring element, which is a simple wire shaft. Figure 5 is easier to understand.

The pointer attached to the platform indicates the small rotation in response to the motor reaction torque. It looks and works like the scale and pointer on an automotive torque wrench.

To keep the costs low, special parts were avoided. The bearing housing seen in Figure 5 is an old scrap motor with the magnets, brushes and armature removed. The bearings were replaced with new bearings to minimize friction. The motor platform is just a scrap gear. The motor is attached to the gear with standard hardware-store stuff.

The text, photos and figures in this first installment contain enough information to build this motor test panel. The second installment, to be published next month, will give construction details with photos, drawings and a list of material. The second part will also discuss power measurement accuracy, describe how to calibrate the motor test panel, and show how to use a spare electric motor as a load. ■

(Continued from page 20)

with a small piece of 1/16-inch wire, which has a 90-degree bend. With the rudder and bellcrank centered, solder the 1/16-inch pivot wire to the pushrod. Next, install the left-hand pushrod and rudder. Center both rudders and join the pushrods with the brass tubing. Check the freedom of the rudder's movement by operating the bellcrank, and check that both rudders are centered when the bellcrank is in neutral. The top center sheeting can now be cemented into place after it has been soaked and formed into the correct shape. The straight elevator is tapered on one side only, then covered and attached to the stabilizer with strip hinges.

The Fuselage

Obviously, using a single wheel in a streamlined pod was a way to reduce landing-gear drag, while it provided the lateral area where desired. Actually, this was practical, because a takeoff was more of a "jump off" with the ample power used. The triangular tail boom provided minimum lateral area and weight aft of the CG.

Basically, the structure is a 3/16-inch-square crutch to which everything else is added. When the crutch has been assembled on a board, the lower fuselage, pod and tail boom can be added before you remove everything from the board. There are some lower fuselage bulkheads that, when erected on the crutch, will allow the lower longerons to be installed and joined at the wing T.E. With the tail post, the lower tail boom (3/16-inch-square) can be installed and connected to the point made by the lower fuselage longerons. Then all the required uprights and the Warren trussing can be added.

The wheel pod has one plywood bulkhead to which the 1/16-inch wire wheel mount is bound with copper wire and epoxy. With all the pod formers in place, the 1/8-inch-square stringer notches can be made. One at a time, locate each stringer on the outside of the formers, mark the notch locations, cut the notches and install the stringers.

Next, remove the fuselage from the board, add the wing-mount bulkheads to the top, and align the 3/16-inch-square wing saddles to them. The top tail-boom longeron is then added, followed by all the required uprights.

There's some 1/8-inch sheet flooring for mounting the batteries and the reciever, and there's also some "fill" to be added (1/16-inch-square in the stab/boom area and 1/8 inch everywhere else). Do add some 6-ounce glass-cloth to the battery floor, because it doesn't take much to make those heavy batteries go through balsa as if it were butter!

Complete the fuselage details, e.g., the servo rails, the wing and the stab screw mounts, etc. Block-sand the outside until it's smooth.

With this modern electric-powered version of the Blitzkreig, a considerable amount of streamlining can be done at the front end. For the motor cowl and the upper and lower fuselage fairing behind it, I opted for foam because it's light and easy to work. Oversize foam blocks were installed, and then the whole piece was carved and sanded to fair into the spinner. When this had been completed, the entire nose back to the wing L.E. was covered with 1.5-ounce glass-cloth and resin, with two layers on the motor cowl.

Assembly

Align the wing to the fuselage by making adjustments to get equal measurements from the tail post to the T.E. polyhedral joints. When you're satisfied, drill a pilot hole for the hold-down screw; then drill and tap 8-32.

The stabilizer is next. Scribe an exact center line on the stab bottom sheeting, and on this, drill two No. 29 holes spaced to suit the ply mounting plates. With the stab in place, locate the aft mounting hole on the tail boom. Drill and tap 6-32. Attach the stab with this screw. On top of the wing L.E. bulkhead, drive a straight pin exactly into the center line. Measure from the pin to the stab T.E. where it joins the fins, and make adjustments to get equal measurements. Mark, then drill and tap the forward hole.

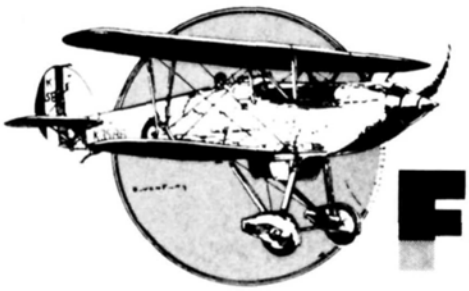
Finally, with the wing attached, set the model on a table. Block the fuselage with books, etc., until the measurements are equal from the table to each polyhedral T.E. joint. Then check from the stab T.E. at the fins to the table and, if necessary, shim the stab/boom mount to get equal measurements.

Finally, check the balance point without the wing, because it's much easier to do it this way, and the point shown is for this method. If necessary, move equipment or add ballast to obtain the correct location. Remember that a correctly aligned structure is good insurance against unpleasant surprises on that first flight!

Equipment Installation

Power and R/C equipment should be installed and operating correctly before the covering is applied, because accessibility is much better at this time. The power

(Continued on page 76)



Fifty Years Ago...

by LYNNE SEWELL

IF YOU WERE ALIVE and sensible in late 1939, you would have undoubtedly tripped along the Yellow Brick Road with Dorothy, Toto and assorted unusual friends in pursuit of the land of Oz. Fifty years ago, the world was changed forever not only by the terrors of war in Europe, but also by the release of the remarkable "Wizard of Oz." It came at exactly the right time—a time when everyone was ready for its spectacle, fantasy, and, of course, the triumph of good over evil.

While Dorothy's strange companions pined for a brain, a heart and courage, these commodities were much in evidence in the *real* world. The realities of war led to research programs that culminated in amazing new technology and jobs for the millions of unemployed; compassion led wartime neighbors to help one another, hide fugitives etc.; and there was certainly no shortage of courage. For conscripted Europeans in the Armed Services who, like Dorothy, wanted only to be at home, November 1939 was *not* a good month.

In the U.S., when *MAN* readers weren't spending an evening at the movies, they'd obviously be in their basements with the November issue of *MAN*, which, as always, contained more than enough projects to keep them busy until spring. Its dramatic cover showed a spectacular red Folkerts racer, which was described in an article called "Taming the Speed Demons." Entered in the Thompson Trophy Race, with its 16-foot wingspan, it weighed slightly less than 1,600 pounds, and, powered by a 400hp Menasco engine, it was capable of 360mph. Its streamlined fuselage, cantilevered wings and retractable landing gear reduced head resistance to a minimum.

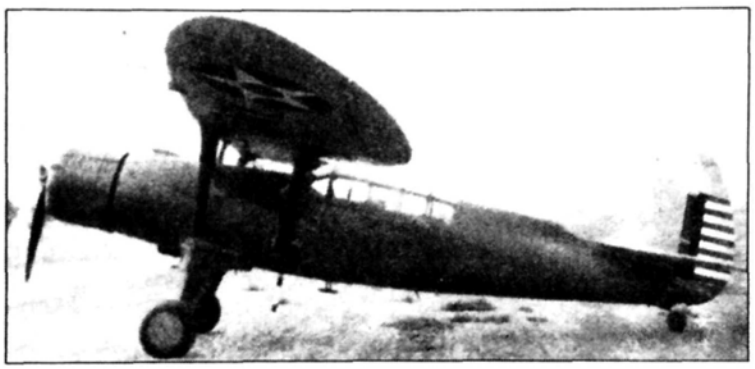
Reducing head resistance on a *model* plane was the subject of "Folding Away the Drag," by Messrs. Lidgard and Simmers. Long a problem, propeller-induced drag could be effectively reduced by using a folding propeller! Just put a hinge on the rear face of each propeller so that the blades fold back along the fuselage, and the decrease in drag would be "remarkable." When the blades folded backward, drag instantly decreased, and this, in turn, increased the L/D and enabled a plane to glide more proficiently. (Incidentally, Pappy DeBolt tells you exactly how to fold your props in this issue's article on electric props.)

1939 Winner! Dick Korda's famous plane soared at 2,000 feet!

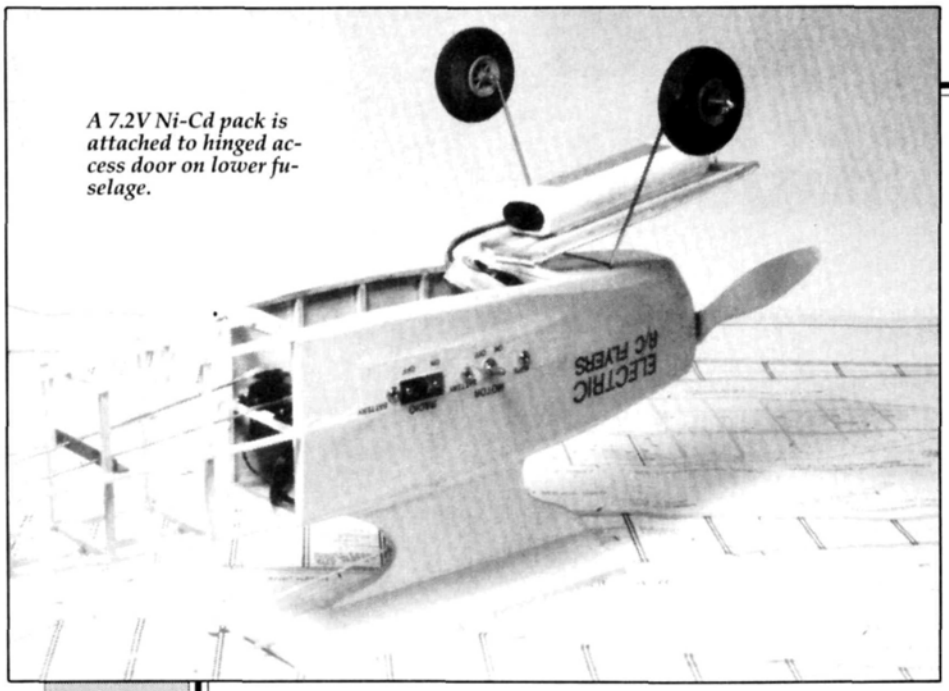
Properly designed for stability and high performance, the Powerhouse was sturdy, yet simple in construction.

When you'd finished folding your props, you could use the supplied plans to make a miniature Douglas 0-46A (then the U.S. Army's finest observation plane). Nicknamed the "Flying Razor" because

(Continued on page 114)



The Douglas 0-46A U.S. Army observation plane.



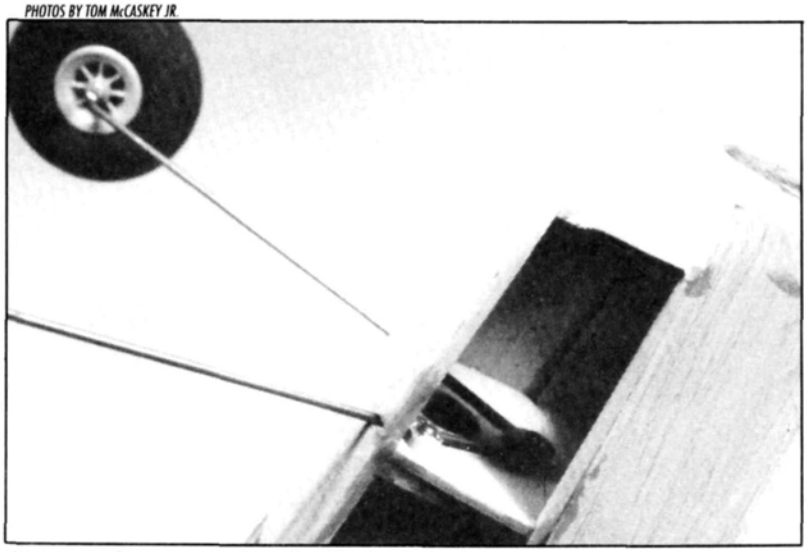
A 7.2V Ni-Cd pack is attached to hinged access door on lower fuselage.

ELECTRIC RADIO CONTROL FLYERS

A long-time modeler returns to a new, electric world—and loves it!

by TOM McCASKEY JR.

PHOTOS BY TOM McCASKEY JR.



For ease of transportation, the Playboy's landing gear was modified to make it removable.

BESIDES TAXES, we can always count on change, and for a long time, I've anticipated the changes in technology that have made the electric R/C model airplane a reality.

For five years during the '70s, I edited a quarterly magazine called *Electric Vehicle News*. At that time, because of troubles with the OPEC countries, the electric car was being given considerable attention. The first electric-car convention/exhibit was held in 1972 in Atlantic City. "Electric" companies were springing up everywhere, and one-person and two-person shops were started in garages. Large corporations showed only a token interest until Congress passed a $160 million bill relating to Electric Vehicle Research and Development and then overrode President Ford's veto.

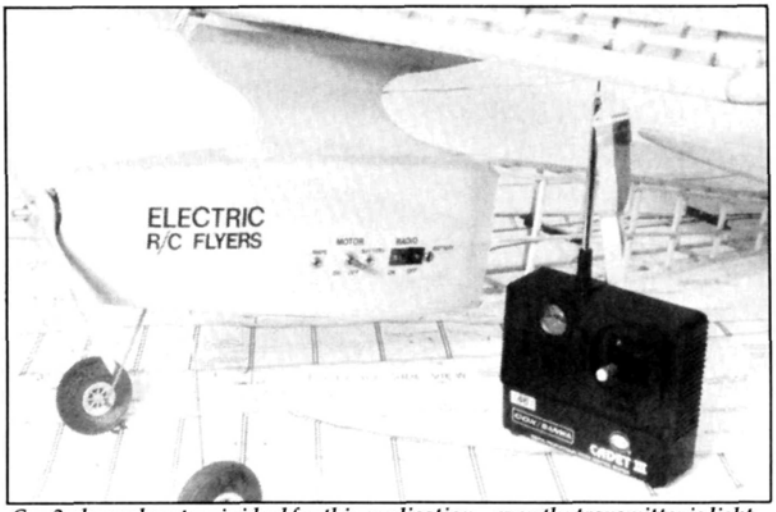
There were promises of a battery breakthrough. The astronauts had one of the new batteries on their moon rover; its cell plates were made of silver and each 12 volts cost more than $25,000. I took a red convertible Fiat that had been rebuilt as an electric to the New York Coliseum for the Annual Auto Show. At the door, the show's staff insisted that they should empty the gas tank to meet the fire marshal's regulations. I tried to explain that there was no gas tank, no muffler, no noise, no pollution, etc., but they said they had to *push* the car to the exhibit booth anyway. Six guys started to push, but they couldn't keep up with the car when I turned on its silent electric motor. I'll always remember their looks of disbelief, which I saw in the rear-view mirror as I pulled away!

Standing on the boardwalk one evening during that first convention in '72, I told my magazine partner, "You know, it would be great to fly a radio-controlled electric model airplane some day." I explained that, as a kid in grade school, I had spent many hours building and flying rubber-band-powered scale models, when the kit cost a quarter and a bottle of banana oil-glue cost a nickel. There were no solid-state radios then, and the transistor had yet to be invented.

After surgery last fall, I decided to retire, to follow my doctor's instructions not to lift more than a book or drive a car for four weeks, and to start doing the things that I'd *always* wanted to do. I've been in ham radio operator for 35 years, and I

have a computer, but what about other things? Were there other personal goals that hadn't been fulfilled, but had been shelved for these retirement years? Most definitely! I had always wanted to build an electric plane.

As a 60-year-old, I felt a little foolish when I started building a plane, but I was encouraged by the great enthusiasm of my retired ham-radio friends, who come by regularly to check on my progress. They vow to have several VCR cameras present when my creation takes to the air.



Cox 3-channel system is ideal for this application—even the transmitter is lightweight!

I chose to build the Leisure* Playboy and to use the Cox* 3-channel, one-stick radio, because I remembered seeing the original fly when I was a Boy Scout. The weight of the fuselage hangs like a pendulum well below the wing, making it a self-correcting trainer and much easier to hand-launch, when required, than a low-wing plane. I like the single-stick transmitter because it's more like those on antique planes. Above all, my premise was KISS (Keep It Simple, Stupid).

I wanted a plane that I could carry in the trunk of my car. When I'm passing a vacant school yard and not in too much of a hurry, when the wind is right, I want to stop, mount the wing, turn on the switches, check the rudder and elevator movement, then advance the throttle to start the motor and *quietly* get airborne. I don't want the noise, motor-starting problems, dirt and limited flying areas that I associate with glow plugs.

It wasn't easy to resume this hobby, although when I visited hobby stores in my area, I found they hadn't changed much in 20 years. They had no electric planes and didn't seem interested, so I read through the Yellow Pages. No one knew *anything* about electrics. I called Cox on the West Coast, but they couldn't tell me where I could buy their products in the Philadelphia area, and their factory reps in New Jersey couldn't tell me either! I took my credit card and called the catalog houses, but it took three suppliers to get what I wanted. No one could tell me anything about solid-state motor controls, so I picked up a couple of microswitches at Radio Shack and built a servo on/off switch that works very well.

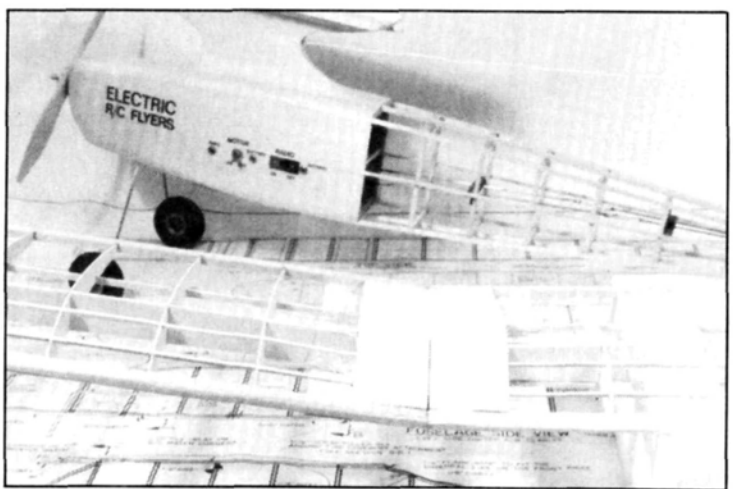
I've modified the Playboy to suit my needs. Its landing gear can be quickly removed if I want to fly in a wheat field. The wing quickly folds in half, if I want to put the plane into a small car. The top of the pylon is flat, so the upside-down fuselage will support itself on the workbench while I operate on its belly.

There's more! I think we're witnessing the infancy of another craze like the hula hoop, and I want to be part of it. I see a great potential in the retiree market; many have money, as well as time, on their hands. Every retirement community seems to boast a woodworking shop, and many have golf courses and, therefore, flying space.

• To model manufacturers I say: Don't try to hide the fact that a plane is electric; I intend to write "electric" in big letters on the wing of mine. Electrics can fly where the others can't; the police will be more understanding; the press will be more interested. When I had an electric car in the '70s, I immediately put "electric" on the body where everyone could see it. Other drivers gave me a friendly "toot" and thumbs-up signs; and the local newspaper quickly featured my car in a Sunday section. To buy this page as advertising would have cost mucho bucks!

Start talking to one another. Get organized; have a marketing con-

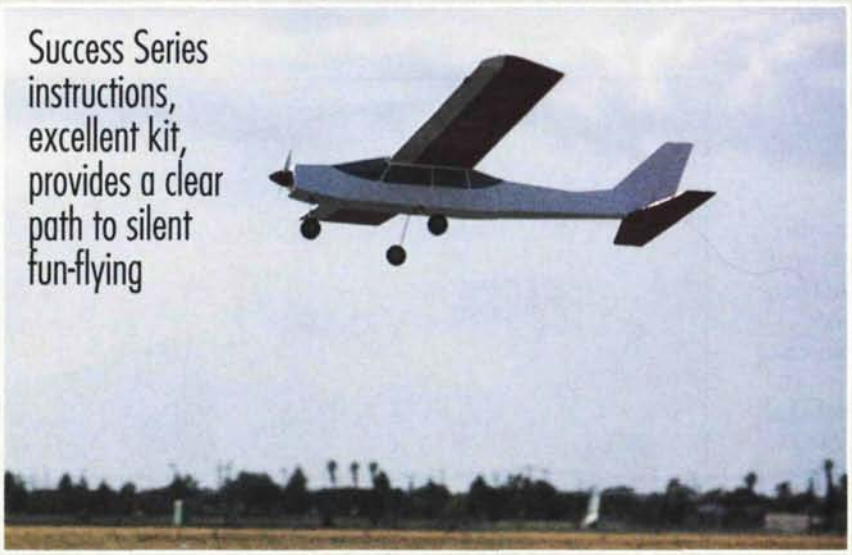
(Continued on page 82)



Leisure Playboy typifies the "O/T" approach to electric flying that's gaining in popularity. With the new broad range of power available in motors, there's something for everyone.

MIDWEST AERO-LECTRIC

Success Series instructions, excellent kit, provides a clear path to silent fun-flying

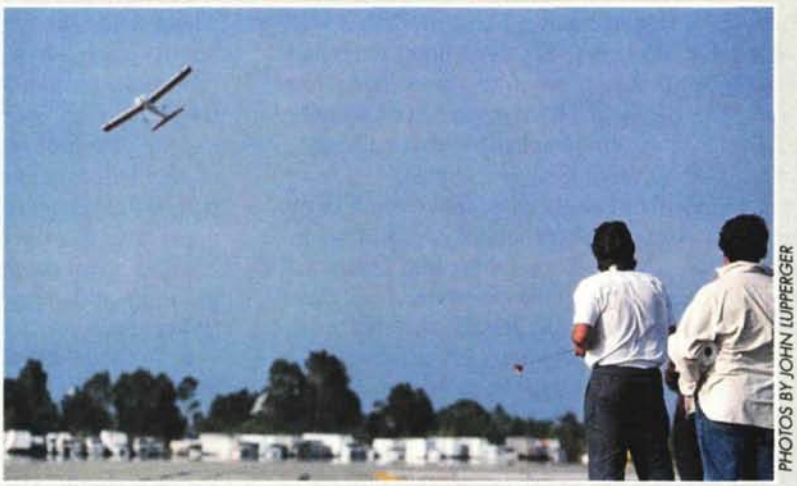


SPECIFICATIONS

Type: *Primary trainer*
Span: *50 inches*
Weight : *48 to 54 ounces (ready to fly)*
Area: *393 square inches*
Wing Loading: *17.5 to 19.7 ounces/square foot*
Power Req'd: *Midwest HP-100 (Mabuchi can motor)*
No. of Channels Req'd: *3 (rudder, elevator and speed controller)*
Suggested Retail: *$99.50*

by JOHN LUPPERGER

The Aero-Lectric, from Midwest, is designed as a primary trainer. It will help beginners to learn to build and to develop the skills necessary to fly and operate a radio-control model. It uses a direct-drive motor that operates well on a 6-cell battery pack. With its available power and tricycle*



PHOTOS BY JOHN LUPPERGER

The Aero-Lectric taxies out for its first ROG takeoff at Mile Square park in Southern California.

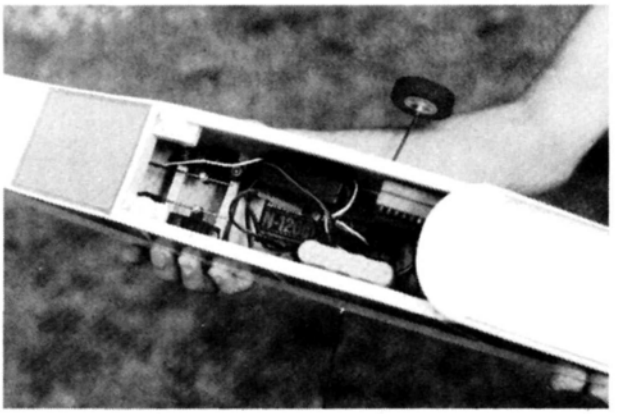
landing gear, the Aero-Lectric can even take off from paved surfaces. Its looks and its flight characteristics will appeal to power flight enthusiasts, because, unlike many electric trainers, the Aero-Lectric is an electric "power" plane, not an old-timer or a converted glider.

THE KIT: The kit was packed well and arrived in good condition. All parts and wood were carefully bagged, stacked, and/or "rubber-banded" together. The quality of the wood was excellent, and the density of each piece seemed to match the strength needed for the part concerned. The quality of the die-cutting was well above average, and all die-cut parts were easily removed from the sheets.

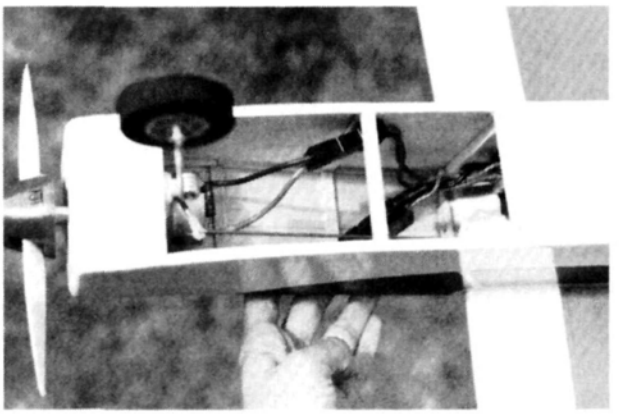
The plans are on two sheets (wings on one, fuselage and empennage on the other), and these are very clear and easy to read. The 112-page construction manual (that's right: 112 pages!) contains more information than some books on R/C. There are nearly 300 line drawings to help you with every phase of building, radio installation, covering, electric-gear installation and flying. The kit is one of Midwest's Success Series, and I'm sure that many fledgling builders and pilots will attribute a big part of their success to this excellent manual.

A Midwest HP-100 motor is also included in the kit. As this is a slightly hotter wind than the Mabuchi can-type motors that come in most kits, it comes with a 7x6 Grish prop (instead of the usual 8x4 or 8x6) to ensure reasonable motor run times. The kit also comes with a 1 1/2-inch Goldberg* snap-on spinner and Dave Brown-style light wheels.

CONSTRUCTION: Aside from the size and weight of the wood that's used, the Aero-Lectric is constructed in the same way as most powered trainers. Each step in the instructions has a box that should be "checked" as the step is completed so that you can be sure every step has been followed. Since the building manual is excellent, I won't go into as much detail as usual on the building of this review model. Believe me, you'll probably never see a more detailed kit manual.



Radio compartment is full, but not stuffed or cluttered. Radio components use Velcro for attachment to the fuselage bottom and sides.



Normal tank area is empty apart from the motor. Steerable nose-gear linkage is simple, but effective. Bottom hatch makes access for adjustments quick and easy.

Cooling holes are large enough for good ventilation, which goes through entire fuselage and exits at the rear.

Construction starts with the tail surfaces, which are made of 3/16-inch balsa-sheet parts. The wood was light but relatively stiff. After sanding in the leading edges and hinge lines, the hinge slots are cut.

The fuselage, which is a basic box built up of sheet sides, bulkheads (balsa and ply) and balsa stringers, is built like those of most power models, but it has slightly less structure and uses smaller sizes of lighter wood.

My only problem was with the F-5 tail formers, which align the rear of the fuselage (one on the top, one on the bottom). The top is the base for the rudder; the bottom is the base for the elevator. It tapers from the front to the rear of the fuselage, and it's the taper that seems to cause the problem. This is a die-cut piece and, because it's tapered, I didn't notice that it wasn't square, but it became quite obvious when the sides were pulled together and glued. A twist developed in the fuselage, and I could only get rid of it by splitting F-5 down the middle and removing a triangular splinter. This worked, and the fuselage ended up straight. Check this before gluing, and you shouldn't have any problems.

The wing is a conventional, double sparred, D-tube structure. If there's any fault in the wing, it's that it's too strong. Construction is straightforward and simple. There's even a preshaped, balsa, leading-edge sanding block in the kit. After sanding the wing, the center section is reinforced with a strip of supplied fiberglass tape.

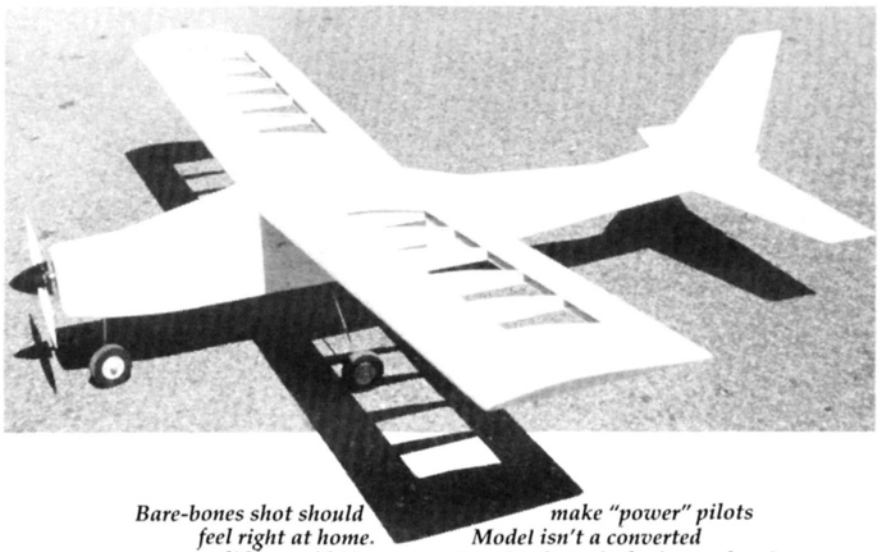
The instructions tell you to assemble the parts at this point, but I strongly recommend that you wait until you cover the model.

The servos, control horns and pushrods are installed next. The motor and switch harness are installed, and the motor is secured to the fire wall with two screws. I used a Novak* T-l Tempfet speed control in my model, but I didn't mount it until later.

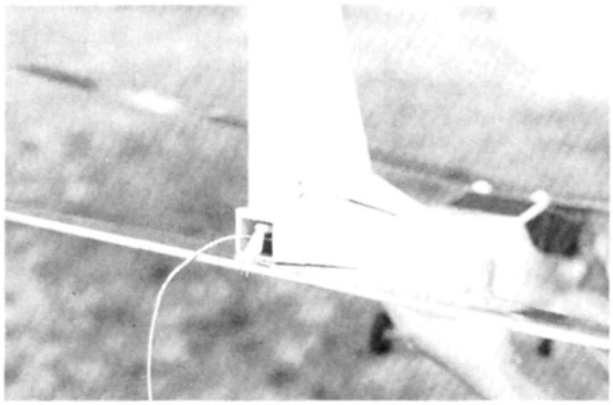
The final step is to locate the wing hold-down blocks, the blind nuts and the wing hold-down dowel.

COVERING: First, sand the entire model with successively finer grades of sandpaper. This really pays off when you apply the final film. I used Top Flite's* Super MonoKote—white and red—and trimmed with Goldberg striping tape. The supplied window graphics and flying-lights graphics finish the model and make it look realistic. The Aero-Lectric graphics on the wing were supplied by Mr. Sticker*.

RADIO INSTALLATION: The fuselage is quite roomy, and radio installation is a breeze. The rudder and elevator servos fit on rails at the rear of the radio compartment. I used a Cirrus 5 PCM with two CS-133 micro servos and a 250mAh battery. The flight batteries, receiver, radio battery and speed control are all mounted with Velcro, and this makes a very neat installation that stays put. By shifting the position of the various components,
it was very easy to balance the model.



Bare-bones shot should make "power" pilots feel right at home. Model isn't a converted glider or old-timer; construction is typical of a good trainer.



Pushrod exit also doubles as cooling-air exit. With the horn in the center of the low-mounted elevator, no additional holes are cut for control rod.

PERFORMANCE: The first test flights were done at the local glider field. The ground is a little rough for ROG takeoffs, so the model was hand-launched. A few steps, a straight-ahead toss, and the Aero-Lectric was on its way. The climb-out was steady, and the model needed no trim changes. I spent the first flight checking out the model's flight characteristics. Everything was fine, and the Aero-Lectric proved itself to be free of bad habits.

On its next time out, the Aero-Lectric made a trip to Miles Square Park to check out its ROG capabilities on a paved runway. There were several "power pilots" present, and they showed a great deal of interest in it. The model was taxied out on the runway (easily accomplished with the Novak speed control), lined up on the center line (the steerable nose gear sure is handy!), the throttle opened up, and away it went. After a run of 50 to 70 feet, it lifted off quietly. It's quite eerie to be able to see, but not *hear*, your model pick up speed and take off. The power pilots seemed duly impressed. After I had landed, several of them came over to check out the Aero-Lectric, and I let some of them fly it.

After several flights, the consensus was that I have a very nice model. No one had any real difficulty flying the model, and those who tried it included one with limited experience and ability. The only negative comment was that some of the pilots prefered more power. I explained to them that flight times of 4 1/2 to 5 minutes could be sacrificed to achieve more power either by going to a 7-cell battery pack or to a hotter motor. The more experienced pilots said they wouldn't mind shorter flights, but the novice pilot felt the model was fine in its stock form.

I don't know if I did something special to come in at 45.5 ounces ready to fly (2.5 ounces *less* than the lowest recommended flying weight), but, as with all electrics, I suggest that you do everything possible to minimize weight. I'm sure that its low flying weight had a lot to do with its excellent flying characteristics.

CONCLUSION: The Midwest Aero-Lectric is a very good, complete kit. Its price is reasonable for its quality; the hardware, motor and other accessories are all suitable for the tasks they perform; the plans and unbelievably complete instruction manual will make building a breeze for the novice and an enjoyable experience for the "old pro." Overall, a superb introduction to electrics!

**Here are the addresses of the companies mentioned in this article:*
Midwest Products Co., Inc., *P.O. Box 564, Hobart, IN 46342.*
Carl Goldberg Models, *4734 West Chicago Ave., Chicago, IL 60651.*
Novak Electronics Inc., *128 C East Dyer Rd., Santa Ana, CA 92707.*
Top Flite Models, *2635 S. Wabash Ave., Chicago, IL 60616.*
Mr. Sticker, *18081 Redondo Circle, Suite E, Huntington Beach, CA 92648.* ■

ENGINE EVALUATION:

O.S. FS-40 SURPASS

Well-designed 4-stroke that's long on power, short on noise and great on economy

by MIKE BILLINTON

THE NEWEST 4-STROKE engines from O.S.*—those in the Surpass Series—are a fine response to competitive pressures from other Japanese manufacturers. The unique combination of O.S.'s usual refined construction and the new Surpass Series power levels will probably continue to give O.S. a marketing edge.

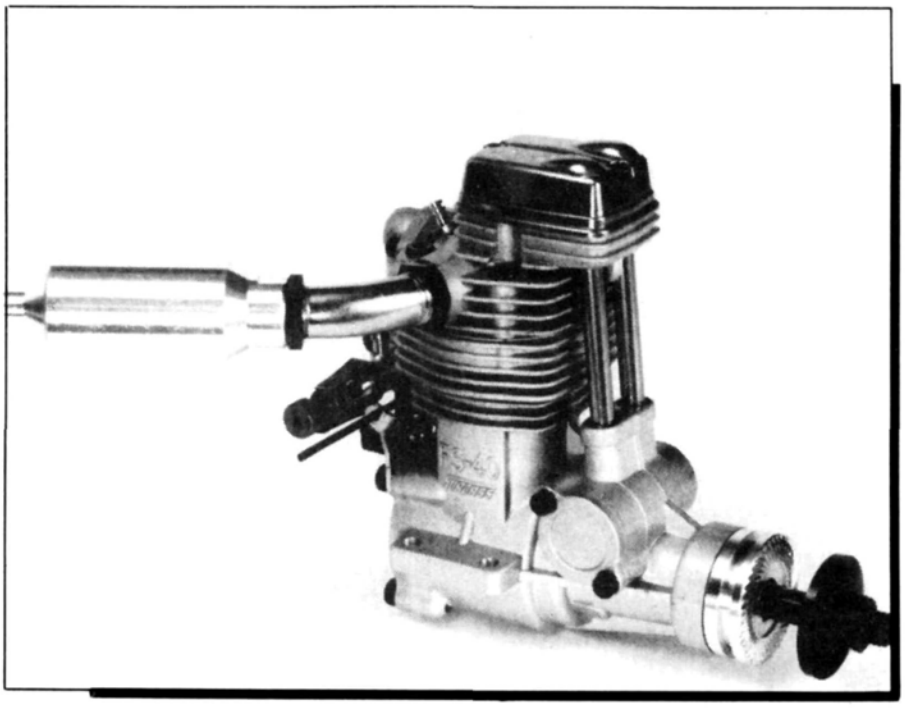
Ranging in capacity from 4 to 20cc (26, 40, 48, 70, 91 and 120 cubic-inch models), the engines show the company's determination to produce a unit to meet every need, and this article features the .40 cubic-inch engine (6.5cc), since it's probably the most popular.

The refinement mentioned is so marked that it seems an offense to strip the engine down to take photographs and measurements, etc., and submitting it to a dynamometer test is a further indignity! But like all other O.S. products, the Surpass 40 is designed to "surpass," so there was really only one way to proceed.

MECHANICAL DETAILS: O.S. has kept its one-piece crankcase that incorporates the front-mounted, one-piece, cam pinion that's driven off a skew gear machined into the crankshaft. This has the considerable merit of ensuring that all controls (carburetion and glow plug) are operable from the rear end of the engine. Although there are advantages to mounting the cam gear at the rear of the engine (i.e., as far as space is concerned, it's easier to use a separately tunable cam for each valve; and the front of the engine is comparatively more streamlined for aircraft use), safety considerations of having the plug and the controls positioned away from the propeller arc are uppermost here.

Using a standard OHV pushrod layout, the Surpass 40 has similarly sized inlet and exhaust valves at 7.5mm head diameter, but the throughway passage diameters leading to the valve seats are dissimilar—6.3mm for the inlet and 5.5mm for the exhaust. With a rocker ratio of 1.35:1, the final valve lift is 2.63mm.

The semi pent-roof combustion chamber with inclined glow plug has much in common with head shapes currently used elsewhere on other models. This shows that, since the early fractious days of the detonation-prone model 4-strokes, ideas about head layout to solve the problem have converged to produce a degree of uniformity. The relatively fixed



The overall appearance of the FS-40 continues the O.S. tradition of quality.

SPECIFICATIONS

Capacity:	.3957 cubic inch (6.484cc)
Bore:	.8345 inch (21.2mm)
Stroke:	.7235 inch (18.38mm)
Stroke/Bore ratio:	.867/1
Timing Periods:	Inlet opens 49° BTDC
(with valve lash	Inlet closes: 70° ABDC
at .002 inch)	Total: 299°
	Exhaust opens: 92° BBDC
	Exhaust closes: 31° ATDC
	Total: 303°
	Overlap: 80°
Combustion volume:	.9cc
Compression ratio:	Geometric - 8.2/1
Cylinder head squish:	.050 inch (1.27mm)
Cylinder head squish angle:	0°
Squish band area:	.081 square inch (52 sq. mm)
Carburetor bore:	.198 inch (5.04mm)
Crankshaft diameter:	.473 inch (12mm nominal)
Crankpin diameter:	.217 inch (5.52mm)
Crankshaft nose thread:	.248 inch x 28TPI (1/4UNF)
Wristpin diameter:	.1975 inch (5mm nominal)
Connecting rod centers:	31mm
Engine height:	3.8 inches (96.8mm)
Width:	1.94 inches (49.3mm)
Length:	3.62 inches (92mm)
Width between bearers:	1.307 inches (33.21mm)
Mounting hole dimensions:	17.5x42.0x3.7mm holes
Frontal area:	5.4 square inches
Weight:	12.1 ounces (343g) bare; 12.85 ounces (365g) with muffler

Performance:

Maximum BHP: .65 @ 13,600rpm (open exhaust); .58 @ 12,700rpm (muffler)

Maximum torque: 53 ounces/inches @ 9,700rpm (open exhaust); 52 ounces/inches @ 8,800rpm (muffler)

RPM on standard propellers: (Figures in brackets refer to cam timing advanced 30°)

	Open Exhaust		Muffler	
12x6 Mastro	7,723	(6,815)	7,583	(6,778)
10x8.3 Graupner (3-blade)	8,210	(7,331)	8,104	(7,259)
12x6 Graupner	8,450	(7,438)	8,468	(7,363)
11x6 Graupner	9,553	(8,441)	9,438	(8,263)
10x6 MK	10,529	(9,268)	10,454	(9,206)
9x6 Master	12,653	(11,094)	12,480	(10,950)
9x4 Zinger	14,340	(12,440)	14,183	(12,326)

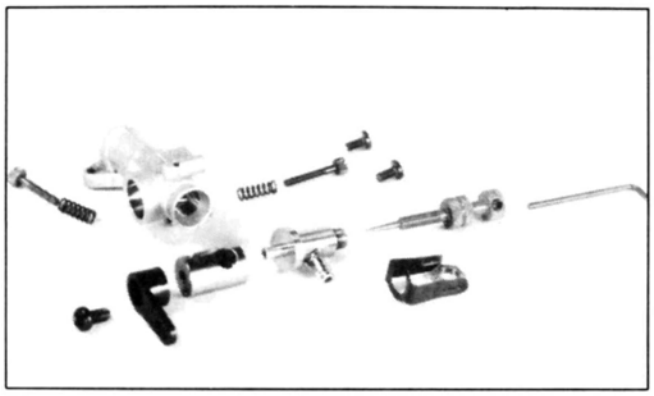
Performance equivalents:

BHP/cubic inches	1.64
BHP/cc	.10
Ounces/inches/cubic inches	134.00
Ounces/inches/cc	8.17
Gram/meters/cc	5.86
BHP/kilo	1.89
BHP/pound	.86
BHP/square-inch frontal area	.12

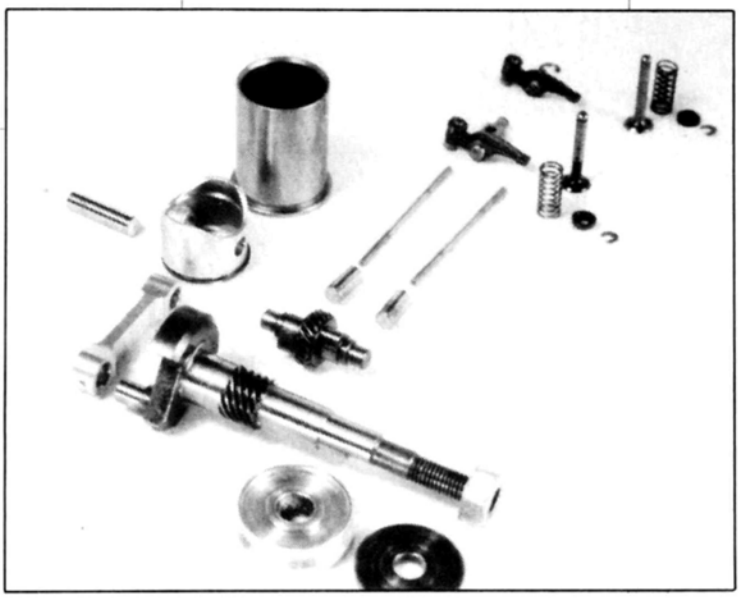
ignition timing given by the glow plug, however, means that the manufacturer must anticipate the possible use of large, heavy propellers (which demand a retardation of ignition timing), and is therefore forced to restrict the 4-stroke to quite low compression ratios as the other means of controlling the ignition point. The O.S. 40 Surpass thus features a low 8.2:1 compression ratio, which ensures survival under high-load/low-rpm conditions, but probably has slightly restricted power at high rpm.

A flat-top piston in heavy-duty aluminum alloy with a single compression ring runs in a steel liner that's coated with the O.S. "Nikasil" process. The high expansion of the piston alloy requires extra bore clearance (compared with the more familiar high-silicon-content ABC piston), so the piston is fitted with .003-inch clearance at the skirt and .005 inch at the piston crown.

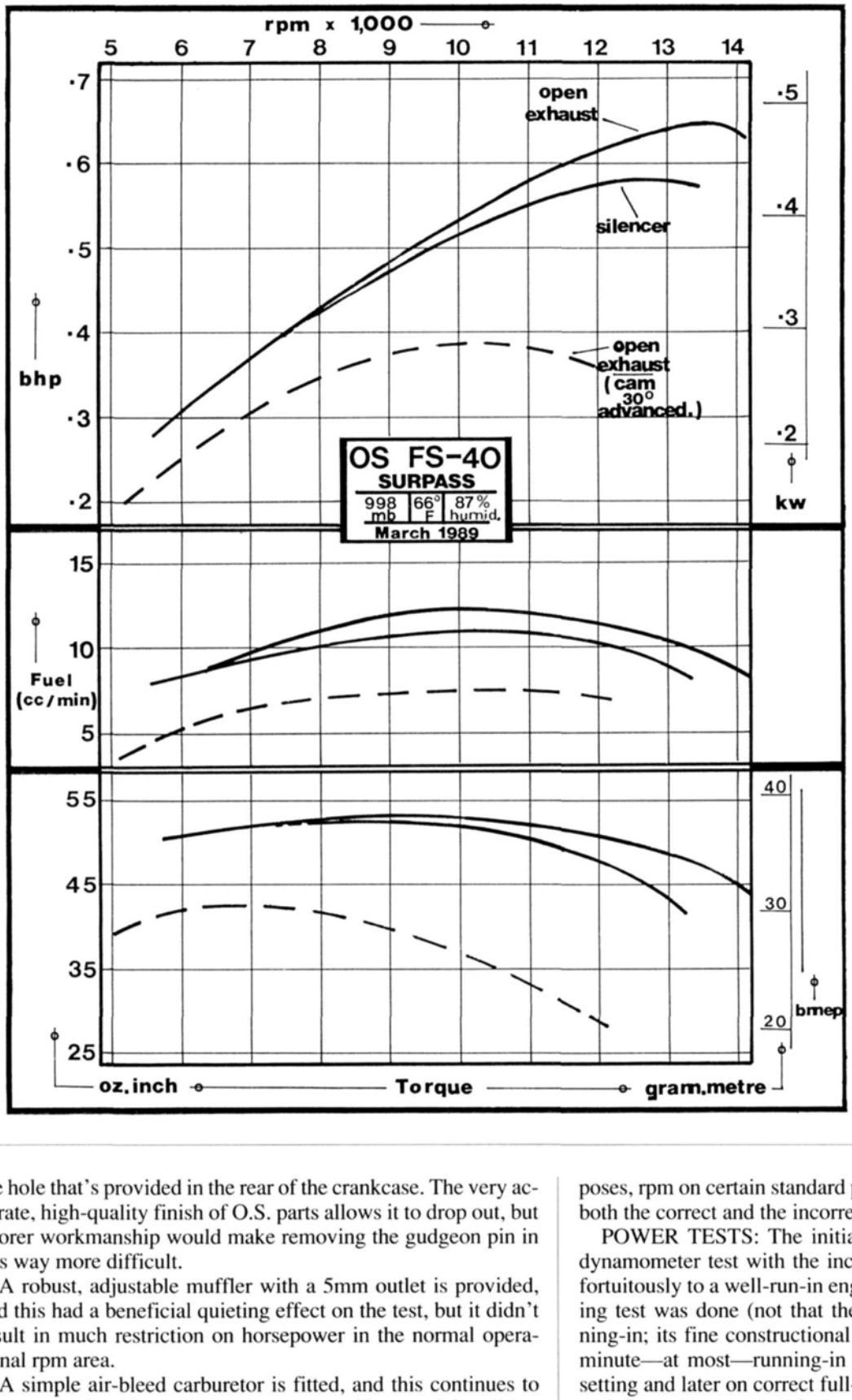
The connecting rod is machined from solid aluminum alloy, and it's phosphor-bronze bushed at both ends and has a single lubrication hole at each end. Because of the one-piece crankcase, the whole rod/piston assembly can only be dismantled by removing the gudgeon pin through



Simple "air-bleed" idling-mixture needle is at top right; main needle at right. Both gave very good, precise control of engine. Extension to main needle is very useful for deeply cowled models.



"Nikasil"-coated steel liner is used with single, unpegged, cast-iron piston ring. Simple helical gear drive is milled into crankshaft.



the hole that's provided in the rear of the crankcase. The very accurate, high-quality finish of O.S. parts allows it to drop out, but poorer workmanship would make removing the gudgeon pin in this way more difficult.

A robust, adjustable muffler with a 5mm outlet is provided, and this had a beneficial quieting effect on the test, but it didn't result in much restriction on horsepower in the normal operational rpm area.

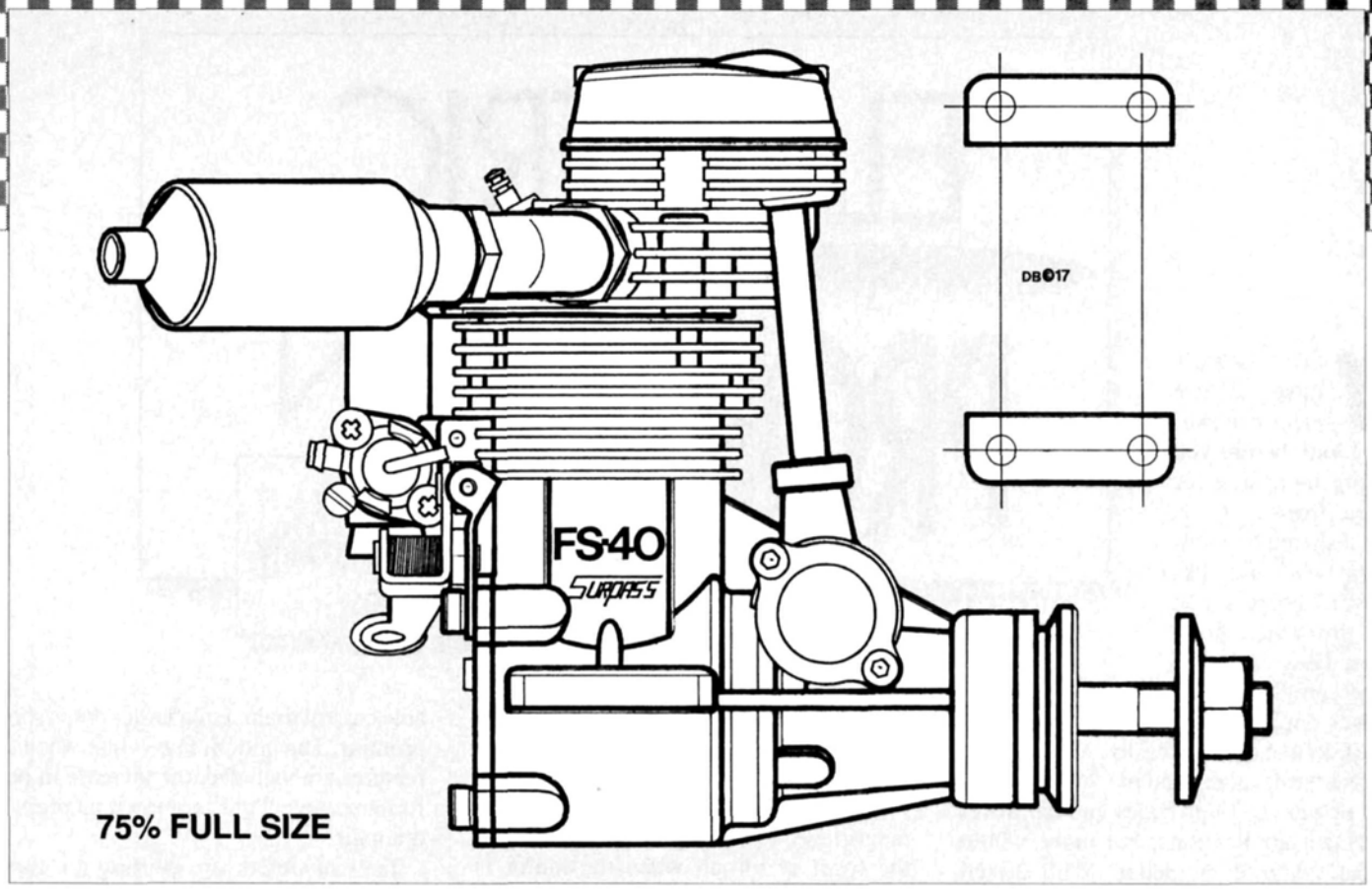
A simple air-bleed carburetor is fitted, and this continues to operate predictably well. For most sports fliers, and for all but the most demanding competition applications, it can't be improved upon. There's also a very practical, foolproof, spring-loaded choke valve for cold starting.

The O.S. instruction leaflet is so comprehensive that it ensures any user successful engine operation, so I was surprised that there was no mention of the retiming of the cam. Since I haven't had much recent experience with 4-strokes, the "self-evident" nature of the reassembly process was probably lost on me! I placed the cam dot as close as possible to the 12 o'clock position (with piston at TDC), and this resulted in such a below-par performance that the O.S. power figures seemed too high. Fortunately, I was told that the cam dot should be at an 11:30 position (in line with backward-raking pushrod tubes), and this changed the cam position by one tooth, so all timings are now correct, instead of occurring 30 degrees too early.

Complete power figures obtained in this incorrectly timed position (dashed line on graph) showed significant power loss from valve-timing change. They also showed that not much had changed as far as fuel efficiency was concerned, because less fuel was drawn through the engine, and this accounted almost entirely for the power loss. (For comparative purposes, rpm on certain standard propellers also show the effect of both the correct and the incorrect timing positions.)

POWER TESTS: The initial propeller rpm checks and the dynamometer test with the incorrect valve timing point all led fortuitously to a well-run-in engine by the time the final correcting test was done (not that the O.S. Surpass needs much running-in; its fine constructional accuracy and finish allow a 40-minute—at most—running-in time, initially on a slightly rich setting and later on correct full-power fuel settings).

O.S. advises an 11x6-inch propeller for running-in and sizes ranging from 10x7 to 12x6 after that (depending on the aircraft). This suggests a maximum ground rpm of between 8,200 and 10,200 when fitted with the muffler. This relatively narrow range probably suits the propeller/model combinations the Surpass 40 will typically encounter, but on the dynamometer test, the muf-



fler rpm range was extendable, with the lowest rpm/full-throttle detonation becoming evident on a heavy 12x6-inch Mastro wooden propeller at 7,583rpm; while at the high rpm end, a 9x4-inch Zinger allowed 14,183rpm—just short of what sounded like imminent "valve bounce." Certainly, torque declines markedly past 14,000rpm, and is also way beyond the practical rpm point of 12,000 claimed by O.S. (It should be noted that, to date, as with all other model 4-strokes currently in production, the O.S. 40 Surpass can't claim the very wide rpm range of the long-developed 2-stroke, but it really doesn't need it for normal purposes.)

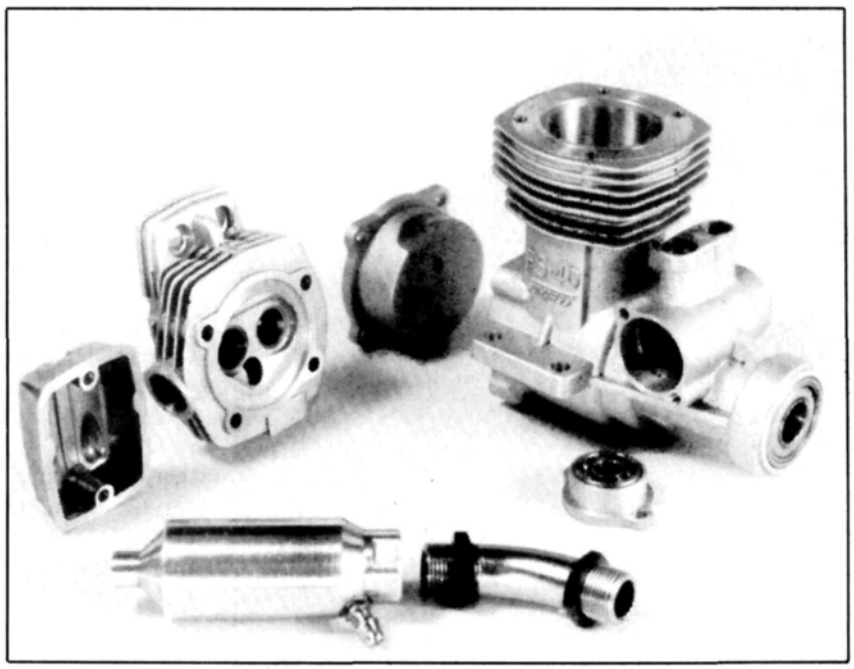
As recommended by O.S., the fuel used on all test runs was 70 percent methanol, 20 percent castor oil and 10 percent nitromethane. The provided O.S. 4-stroke glow plug survived to the end. When finally operated correctly, the test hp reached was virtually identical to that claimed by O.S. (.66 at 12,000rpm), although here it was achieved at the higher rpm point of 13,600. Fuel consumption was also directly in line with the O.S. prediction that a 150cc tankful would last approximately 12 minutes (12 percent cc/minute).

Muffler idling speeds between 1,400rpm (on a 11x6-inch Graupner* propeller) and 2,100rpm (on a 10x6-inch MK propeller) were easily achieved, and with exemplary pickup, once air-bleed control had been optimized.

SUMMARY: For sheer refinement and precision, the O.S. model engine continues to be unsurpassed, and manufacturers hoping to compete by improving on it had better look elsewhere to do so—perhaps to higher power or reliability. So far, there's little evidence (other than in certain very specialized competitive areas, i.e., 15cc marine, 2.5cc FAI glow and diesel engines) that O.S. is ready to concede its place as top runner in the model engine field.

**Here are the addresses of the companies mentioned in this article:*
***O.S.;** distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*
***Graupner;** distributed by Hobby Lobby International, 5614 Franklin Pike Cr., P.O. Box 285, Brentwood. TN 37027.*

■



The Surpass 40 features usual exquisite workmanship. Muffler unit proved solid and effective in test.

ELECTRIC PROP DESIGN

Do-it-yourself electric "folders" using commercially available props

by HAL deBOLT

YOU DON'T have to use electric power very long before you begin the search for more thrust. It's a quest shared by modelers who use gas power. There's one big difference, however: They can go to bigger, higher-horsepower engines. We electric enthusiasts can't do that quite as easily.

Don't misunderstand me; today's electric power (E.P.) provides enough thrust for most applications, but *more* would make things even better. With "fixed power," the only way to realize gains is by improving efficiency, and beyond the power source, converting the power to thrust, we have the propeller. Quite a few modelers, including me, have found many high-efficiency features in propellers tailored for E.P., but unfortunately, prop manufacturers just haven't recognized the special requirements of E.P. props. Sooner or later, they will, but for now, they seem to think their glow-engine props are good enough.

Electric power has different requirements, e.g., we gain additional power in the form of torque when the motor is geared down to produce prop rpm far below motor rpm; we also increase propeller efficiency at lower rpm. Additional thrust has come from large diameters and blade areas with these geared systems. As a result, we need props designed specifically for the lower end of the rpm spectrum, and that's in quite a different ballpark.

PHOTO BY TOM McCOY

Our "electrified" author smiles in approval of the performance of the folding-prop-equipped Hot Wire.

So what makes for an efficient, geared-motor prop?: large-diameter, relatively high-pitched, thin, low-drag airfoils. Let's take an 05 motor geared 2.2:1 as an example. This combination seems most efficient with an output rpm of about 5,000, and an efficient flying speed for a E.P. model would be about 40mph. Using a simple formula: Pitch = mph ÷ rpm x 1,230, we find that the required pitch for these numbers is about 10 inches. Experience has shown that this type of power package will handle a 12-inch-diameter prop (or more) with a 10-inch pitch at an acceptable current drain. Even larger props show promise. The bottom line is that when *all* features are included, the increase in performance over "gas" commercial props is dramatic.

Few modelers are willing to carve props from scratch, and this is understandable, but we all want to improve performance. Fortunately, considerable, but perhaps not the ultimate, gain can be achieved by reworking these *commercial* props. The problem has been to find *suitable* examples to rework, but we might now have a solution.

It starts with the couple of hours of labor needed to rework the commercial prop to meet E.P. needs. In the interest of the efficiency levels we're looking for, this frequently dictates that changes include the use of a prop-folding system. After you've tried this method and seen how well your airplane flies, you'd never want to break it while landing! A folding prop also reduces drag, so a folder neatly meets two needs.

There's more! Remember that we want to adapt *existing* props to our needs. The fact that we have to add a "folder hub" to a given prop is an asset, so smile for a change! Using a folder hub with any prop blades automatically *increases* both the *diameter* and the *pitch* (the two basic increases needed for E.P. and, unquestionably, the most difficult to find commercially). A rule of thumb: For a $1^3/4$-inch spinner clearance, the added hub will increase both diameter and pitch by $1^1/2$ inches. So if you want to use a 12x10, buy a commercial $10^1/2$x$8^1/2$, which is an unusual size, but a more common 11x8 would come very close to it.

ELECTRIC PROPS

This idea has opened doors to further E.P. prop research, which had once been so difficult. It has been relatively easy to try large diameters and high pitches, but why do it? Who said you'll never know unless you try? I doubt that *anyone* has yet found the *ultimate* prop for E.P.; only by experimenting will we find it. We *have* discovered basic ways to improve efficiency; only the fine-tuning remains. Even if you aren't interested in improving the "breed," I'll show you how you can fly better with very little effort.

MATERIALS: a suitable commercial prop; a piece of hardware-store aluminum channel; 1/8-inch brass tubing; 3-48x3/4-inch screws and locknuts; a small piece of 3/8x1/2-inch maple motor-mount stock.

TOOLS: a drill press and drills; a band saw; wood rasps and files; sandpaper; elbow grease!

I'll use the example described as a base for the procedure. When choosing a commercial prop, look for maple one (most are these days), even though we've had success with some old basswood props. Just remember that the hub-pivot area *must* be strong, but at the lower E.P. rpm, strength isn't crucial in the rest of the blade. Don't choose just any commercial 11x8; look for the one with the *widest* blades (there are none *too* wide!). We can use all the available blade width.

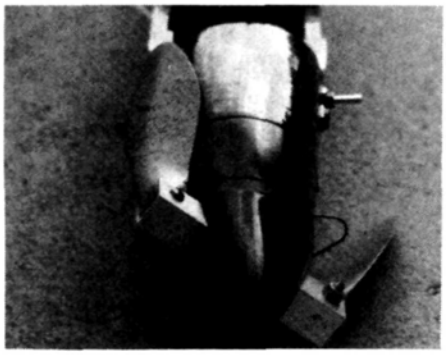
With your chosen prop, you have two choices: Completely rework it, or leave the blades as they are and try them first. Remember that it's much *easier* to rework the blades before the prop is cut in two. You can make considerable improvements by thinning the airfoil, adding a little under-camber and reducing drag in the hub and tip areas. (For more details on modifications, read my January '86 *MAN* article, which discusses this in depth.)

The most important step in preparing blades to fold is to fit the hub to the aluminum channel. The size is marked on the existing hub, then cut with a band saw to ensure parallel sides. You want a good fit to the channel, so be careful not to undercut. It's better to be oversize at first and fit by filing gradually.

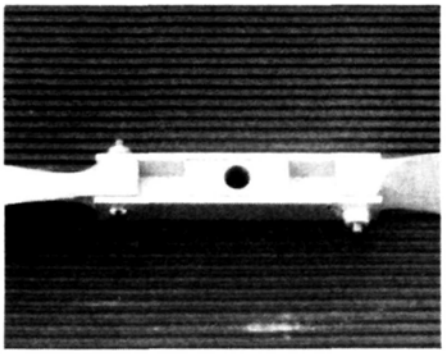
The aluminum-channel folder hub is sized; then the hardwood center filler piece is cemented into place with Hot Stuff*. Determine the exact center on the hub, and drill the drive-shaft hole with a drill press. At this point, *balance* the hub by shortening the heavy side, if there is one. Now the blade-pivot shaft holes are located on the channel and drilled with a No. 41 drill. Clamp one blade hub into the channel at the proper distance and drill the shaft hole in it. Mark this blade and the hub for future assembly reference. Drill the other blade's shaft hole in the same way. Now enlarge the blade-shaft holes to 1/8 inch. Cut and fit two 1/8-inch brass-tube bearings to be press-fit into the channel. (You should be able to tighten the shaft screws and nuts without collapsing the channel.)

Using the shaft holes as a reference, shape the blade hubs as shown. Put the blades into the hub with the bearings and screws, noting the clearance needed for them to fold. Carefully increase the clearance; *don't overdo it,* because for strength, the hubs should be as large as possible, and a good channel-to-hub fit will prevent the blades from twisting under load.

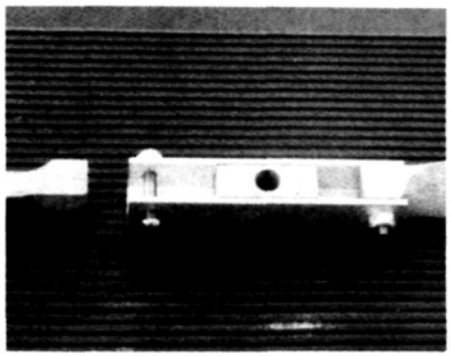
Assemble the prop; check for ease of



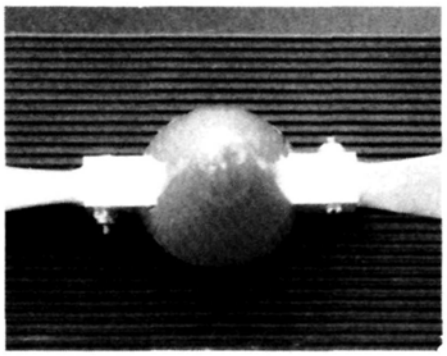
Blades fold neatly to fuselage: no drag, no broken blades, or bent shafts!



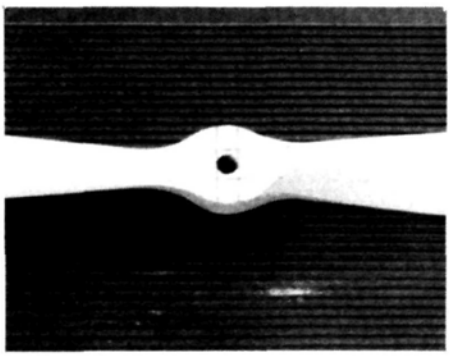
Rear view of hub; note wood drive-shaft filler.



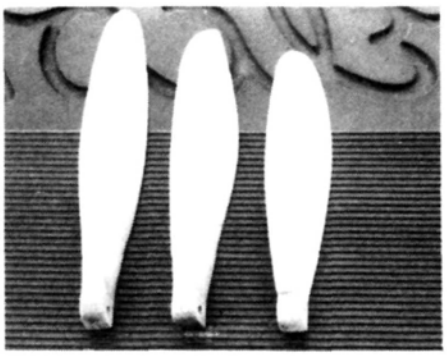
Blade pivots on brass tube axle.



Front view showing Goldberg 1 1/4-inch spinner fairing things neatly. Hub can be sized to suit spinner used.



Layout for cutting hub from a commercial prop.

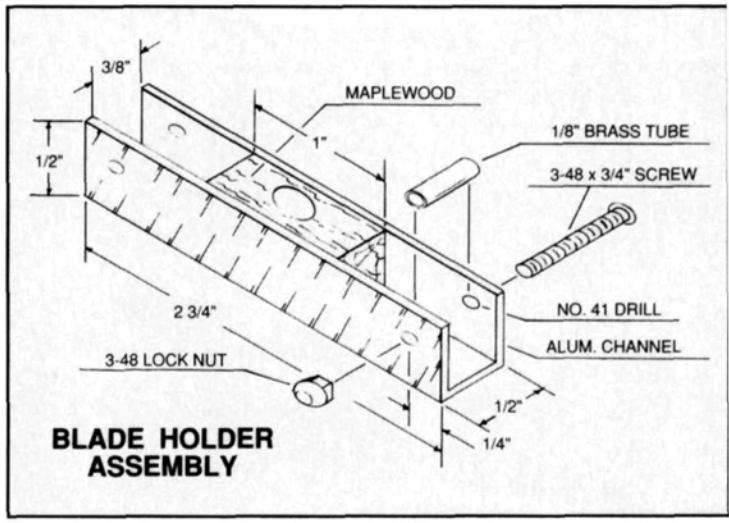


Examples of successful blades: 13.5x9; 13.5x11; 12x12.

ELECTRIC PROPS

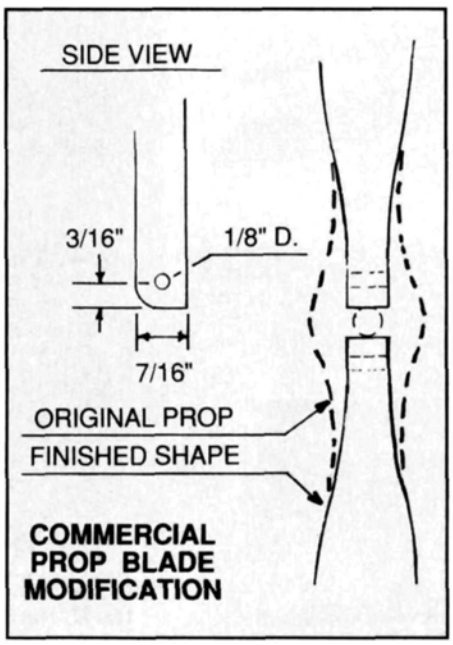
folding; and then balance it. If one side of the blade is heavy, remove a small amount of material from it. *Don't* alter airfoil or the pitch angle!

When the blade hubs have been finished and can fold properly, they can be reinforced with a heavy coat of thin Hot Stuff applied to the hub area. Rub it in with a finger; it will wick into the wood and harden. When it's dry, sand it smooth.



BLADE HOLDER ASSEMBLY

You'll want your new prop to have a professional-looking protective finish, and there's a quick way to achieve this. Spray-can enamel is compatible with commercial prop finishes and dries instantly. When you're satisfied with your



COMMERCIAL PROP BLADE MODIFICATION

rework, polish it with 400-grit sandpaper, then spray it with a medium coat of enamel. When this dries, it will raise a little "fuzz," which can be removed with 400-grit sandpaper. Spray on another coat, and you have a nice finish in minutes!

Obviously, with your folder hub, you can now easily experiment with propellers of various sizes and types. Additional blades can be fitted to the same hub; they can also be easily changed between flights while your batteries are charging. This allows us to experiment and to "tailor" our props for specific requirements.

I'll give you some ballpark figures to start with: Using a 12x10 as a gauge, anything with a small diameter and/or pitch has proven to be inferior to some degree. Notably, sizes above that (up to 13½x12) have produced about equal thrust, so perhaps more work with the larger sizes could produce dividends. Thinner airfoils and further drag reduction still have to be tried, and airfoils of 8 to 10 percent of the chord, at the one-third blade span point, have shown merit (most commercial props have close to 16 percent). For output rpm, 4,000 seems to be a minimum acceptable figure; anything less reduces performance.

Using SC batteries, these power combinations also have a low current drain, with readings of 11 to 13 amps being quite common. Quite an asset! For sport fliers, these easily obtained gains offer some enjoyable flying. The additional thrust will get you to thermal height quicker, and the low drain will allow you to stay there with ample reserve power. Worth the effort? You bet!

For those who aren't inclined toward a little woodworking, there are some commercial, fiber-reinforced, molded-plastic blades that can be neatly adapted to this hub. Their size is 13x7; which has proven to be the most usable, and you can buy them from Tom Dixon*. With these, you only have to drill the pivot-shaft holes and assemble—and enjoy the solitude!

**Here are the addresses that are pertinent to this article:*

Hot Stuff, *Satellite City, P.O. Box 836, Simi, CA 93062.*

Tom Dixon, *STE 401, 1938 Peachtree Rd., Atlanta, GA 30309.* ■

BLITZKREIG

(Continued from page 57)

installation is straightforward, although there might be a need for convenient holes in the bulkheads through which to route your wiring. Keep the R/C components in the area shown for them; don't locate them with the power supply where the potential for picking up motor noise is greater.

All batteries and the receiver are attached to the frame with rubber bands and hooks. No foam insulation is necessary as there's no vibration. The servos are mounted on rails spaced to suit your servos' size.

There's nothing simpler, lighter and more trouble-free than 1/16-inch music-wire pushrods. When run through fairleads, they won't flex or vibrate while operating freely. Find their required route from the servo arms to the tail connections. Where they pass through the forward tail-boom bulkhead and where they exit the boom, install 1-inch-long 3/32-inch-i.d. plastic tubes as fairleads. For further insurance, you can add a small 1/16-inch ply fairlead halfway between the tubes.

The elevator rod is attached to the servo arm with a Z-bend, and a clevis at the elevator horn provides adjustment. For the rudder rod, the clevis adjustment is at the servo arm. A 90-degree bend in the rod's aft end allows it to be connected to the rudder bellcrank, and it also facilitates stab removal.

I assume you have your own particular type of motor control and mechanics. I used the Astro electronic-relay on/off switch, which neatly eliminates one servo and performs flawlessly. It fits into the compartment with the power battery.

Covering

The '38 Blitzkriegs were covered with colored "silkspan" and "clear-doped." (You OTers will understand.) The fuselage was blue; the wing and tail, orange, and the name was hand-lettered with white dope.

I've had really fine results with Coverite's* Black Baron film on several recent models, so it was an obvious choice for this one. I'll add only a little advice to Coverite's instructions for covering this lightweight model. The film comes in rolls, and when cutting the wing covering, you should keep the span oriented with the length of the roll. There will be less sag between the ribs with this grain orientation. Also, try shrinking the film with the same heat setting that you used to apply it. If that's not hot enough, gradually increase the heat slightly until the shrink is satisfactory. The lower the heat used, the less is the shrinkage and the stress on the structure. I also found the B.B. film just as usable for trim; just locate the trim film on the base film and iron it down.

Flying and Adjusting

If you've carefully pre-flighted the wing, tail settings and CG, test flights shouldn't be a problem. The original was a typical "free-flighter," so start with low power and increase gradually while watching for any necessary adjustment "tweaks" to get the proper power and glide patterns. Under full power, it's a "goer," so build up to this point carefully.

The electric-powered version is much simpler than the original. Just test in calm

(Continued on page 82)

FIELD & BENCH REVIEW

FUTABA/HIROBO

PROFESSOR

SPECIFICATIONS

Type: *ARF electric trainer*
Wingspan: *48¾ inches*
Weight: *2 pounds (with propulsion battery and radio)*
Wing Area: *400 square inches*
Wing Loading: *11.5 ounces per square foot*
Power Req'd: *RS 540SH with 3:1 gear reduction (supplied)*
No. of Channels Req'd: *2 (minimum)*
Sug. Retail Price: *$209.95*
Features: *Pre-decorated; light components require only minor assembly. Pre-installed control pushrods and geared motor assembly. Spare prop, tools and epoxy.*
Comments: *Ten-minute flights are usual; allow beginners more stick time. Dihedral brace "pockets" were misaligned and required shimming. Very easy to fly.*

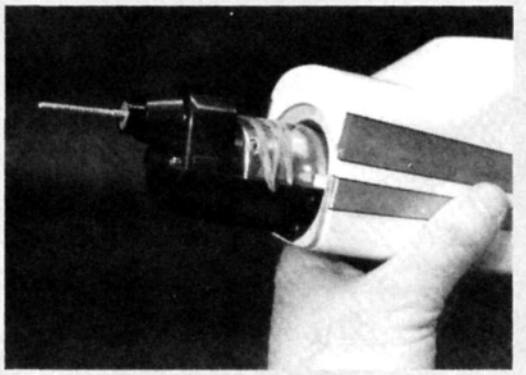
An electric ARF with which the beginner can become comfortable

by PAUL GRADY

THERE'S LITTLE chance of flunking your flight test when this Professor is at the head of your class. Hirobo seems to have come up with an excellent electric trainer for absolute beginners. It has just the right flying characteristics to get a budding R/C ace into the bright blue yonder very quickly.

Futaba* distributes the Hirobo Professor in the U.S., and it certainly chose a winner when it decided to sell *this* one. Why the praise? Well, the Professor flies the way I think a real beginners' trainer ought to. Allow me to stand on the soapbox for a few moments, and then read on if you want to hear the rest of the story.

Slow flight is absolutely essential for a trainer, because it gives the novice a fair chance to stay with the plane and *think*. That's why many R/C instructors favor a glider for this stage of training. But a glider "kites" too easily, i.e., it "balloons" too readily in slight breezes and then stalls. A new R/C pilot follows the oscillations of the



The geared Mabucchi 540S motor fits snugly in the plastic motor mount. The rubber bands work well to hold the motor in place, but should be checked periodically because the motor gets warm and can dry the rubber out.

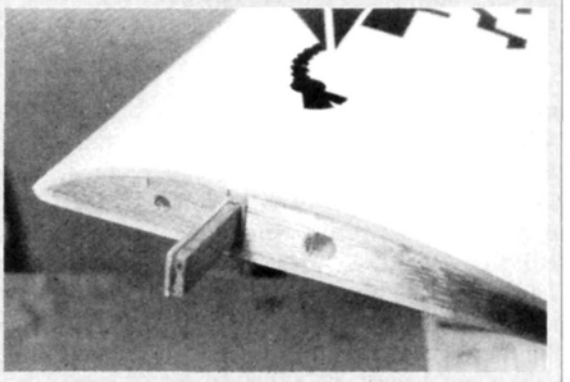


Photo shows the wing root with the dihedral brace and the balsa shims added to help align the wings properly. Shims were added to the rear, left-hand side of the brace and lightly sanded until the wing leading edges were aligned.

glider and can't concentrate on the really fundamental tasks of doing nice, coordinated turns and straight, level flight.

Glow-powered trainers are sometimes a good choice, but they do fly considerably faster than gliders and are much more responsive to elevator input, which sometimes has the novice pilot climbing and diving in the turns and, again, *following* the plane, instead of *leading* it around the sky.

Enter the Professor. This electric trainer seems to fit a very specialized niche between the two. It flies only slightly faster than a glider, but it isn't as fast as a glow-powered trainer. It doesn't "kite" like a glider, but tends to stay put where you send it. It also isn't as responsive to the elevator as a glow-powered trainer is; a sudden, full yank on the stick won't send it "ballistic"! In other words, this benign teacher helps the student pilot learn easily the two most important fundamental flying skills: straight-and-level flight and nicely coordinated turns.

Is all this pure rhetoric? Not on your life! I introduced two absolute novices to the Professor: One had been fighting a glider as a trainer, and the other had been chasing a glow-powered trainer around the sky. With just one flight, both students were comfortably flying the pattern, and I never once had to take the transmitter away. If I've successfully made my case, read on to find out what you get and how well it goes together.

These are the parts as you get them. Most tedious part of construction is cutting out and applying the decals. The manual could be a little more complete and readable, especially for the real beginner.

THE KIT: Almost everything you need to put the plane together is included. You have to buy the radio, the motor battery (or batteries) and the appropriate battery charger, but nothing else. The Professor is one of those "blended" ARFs—a ply framework fuselage with a foam/plastic sheet covering, a balsa frame wing with foam-sheet covering, and dense-foam, prehinged tail surfaces. All the hardware for the pushrods, the control horns, the landing gear and the motor mount is there, as are an instruction manual and a self-adhesive Mylar decal sheet. Don't forget the geared electric motor, the extra 9-inch prop and the Allen wrenches, and the metal wrench and the epoxy, which are used to put the Professor together.

ASSEMBLY: Good flying characteristics might be the ultimate goal when building any plane, but putting it together is just as important. Since the Professor is an ARF, the only building required is assembly of the major pieces, like the two wing panels or the tail pieces, and this is a piece of cake for anyone with building experience.

For beginners, the instruction manual becomes a lifeline. Here, the kit gets decent marks, but not the best. The illustrations are excellent, but the verbal instructions aren't great, being English translations of the Japanese instructions. Read the instructions, but pay closer attention to the illustrations, because they'll help you to assemble the plane

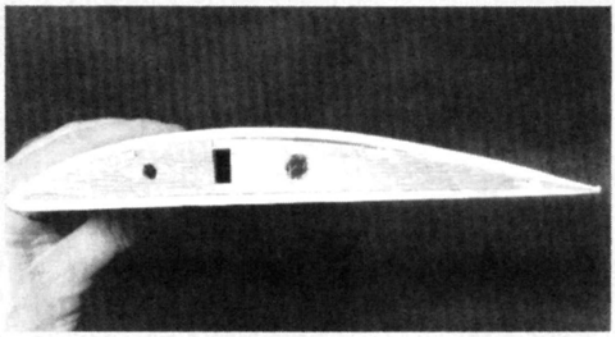
properly.

A long-winded discussion about putting the plane together is unnecessary because it's an ARF, but there are a few important points worth mentioning. Check the wing-to-wing joint before you assemble it. A plywood center-section dihedral brace slips into a pocket at the root of both wings and helps to join them and carry the load of the wing. These pockets were slightly misaligned, fore and aft, and this would have made the leading edge of one wing panel further forward than the other.

If you have this problem with your Professor, it can easily be solved by "shimming." Put a piece of 1/8-inch-thick balsa on the rear of *half* of the plywood brace, and another 1/8-inch-thick piece on the front of the *opposite* half of the ply brace. Based on your own wing, you'll have to determine which half gets the front and which gets the back shim. Then simply sand each as necessary until it fits and the wings are aligned properly.

Even if your wings *do* align properly, you might have to add balsa shims to one side of the ply brace so the wing has a snug fit—*snug, not tight!* This center-section joint is critical, and a good fit is absolutely imperative. No excuses!

Still on the subject of the wing center section: It's important that the plastic sheets that cover the top and bottom center section of the assembled wing are glued properly. These parts fit quite nicely, but it's *your* responsibility to glue them correctly. (They also increase the strength of the wing joint.)



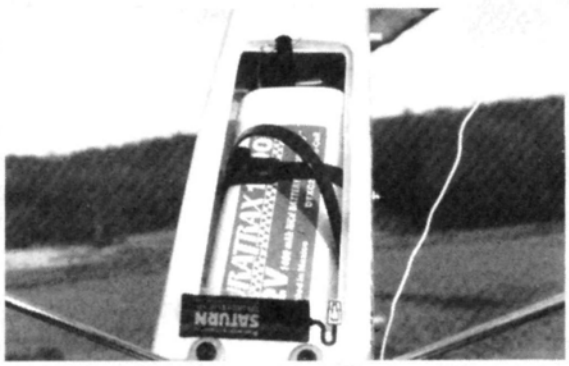
The root of the wing panel, just as you get it. The rectangular cutout is the dihedral brace pocket, which wasn't exactly aligned on each wing panel. The wing uses a balsa framework with a wrap-around foam "skin."

The rest of the Professor can be put together quickly. The tail parts fit quite well; pushrod and control-horn installation is quick; and motor installation is painless. (You simply put the geared motor assembly into the plastic motor mount and "rubber-band" it into place.) The only tedious job is the application of the decals, and there aren't many apply to.

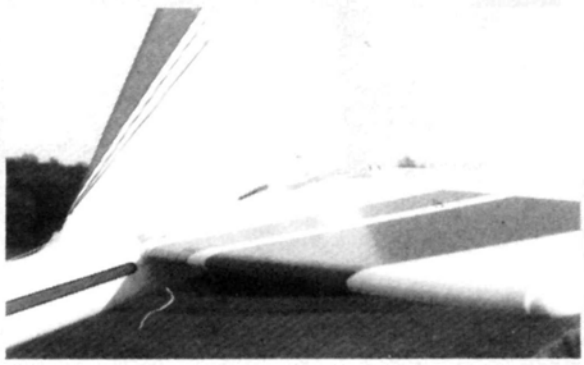
The radio for the Prof must meet a few requirements because of the size of the model and the fact that it's an electric. Mini or micro servos are the best choice and will drop right into the cutouts in the installed ply servo tray. A small receiver and a receiver battery pack are necessary, as is some sort of cutoff switch. All that equipment does fit, but it will "cramp" the radio compartment. To free up some space, you could use a battery-eliminator switch that allows the receiver and the motor to operate from the big motor battery pack. If expenses allow, however, a much better choice would be the new Futaba FP-4NBL Attack radio with the MCR-4A receiver/motor controller.

That was my choice, and not only does it save weight and space, but it's also very convenient. The transmitter has the basic four channels, but the receiver is the *real* gem, because it also functions as a battery eliminator/receiver/throttle servo—all in one unit! That means you can operate the motor and receiver from one main battery and also have a motor that can be "throttled" proportionally, just like a glow engine, instead of just having the simple on/off feature of many electrics. *One important warning:* If you use this MCR-4A receiver, don't wrap it in foam! Because it's also a motor controller, it heats up and needs some air circulating around it. Welcome features of this system are the small S-33 micro servos, which drop right into the servo-tray cutouts without you having to sand the openings to fit.

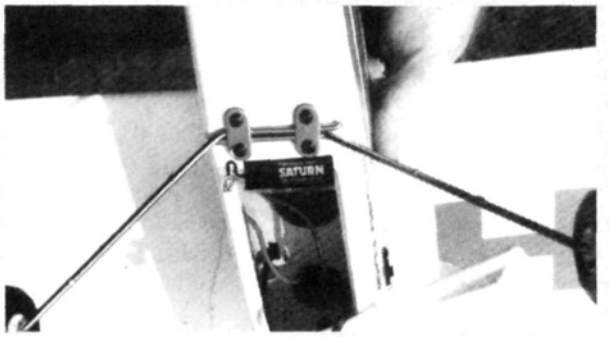
Before I take you out to the flying field for the "lab" section of the Professor's course, one more important



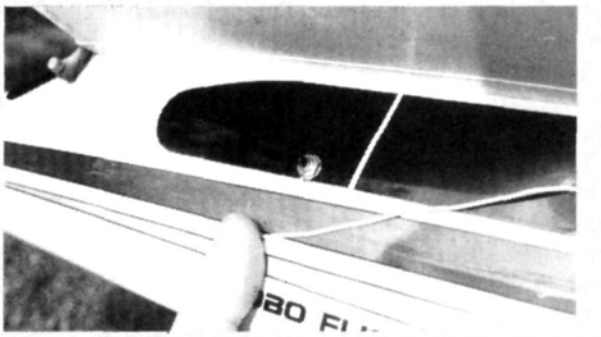
A self-adhesive Mylar tab (with the Saturn label on it) is supposed to hold the thin plastic battery compartment hatch in place. Forget it! Use some other tape (and more of it) to hold the hatch in place.



Rudder pushrod linkage. Set in the fourth hole out on the control horn, the rudder had plenty of throw. Turns were impressively smooth for a rudder airplane—almost like flying a model with ailerons.



Landing-gear legs fit into a pre-contoured slot and are retained by metal clips. Because the plane is relatively heavy, the legs will bend back, or, in my case, slip completely out of the pockets inside the plane. Bending the short plug-in stubs of the wire gear inside the plane to about a 110-degree angle will help prevent the stubs from slipping out of the pockets.



Little push-button switch turns on the motor after the receiver has been switched on. Positioned where shown, it gives a nice comfortable launch without having to search with your finger.

point: Electric motors need breaking-in to seat the brushes in the motor properly and to develop the best possible power output of the motor. In the manual, no mention is made of the need to break-in the motor, but it's a simple process. Get two D-size batteries (you know, the flashlight kind), connect them in series ("plus" end to "minus" end), and hook them to the motor. Just walk away and let it run. The "gentler" voltage of the two D batteries allows the motor to turn more slowly and the brushes to wear-in more gradually and smoothly than if you blasted them with the full voltage of the motor battery right from the start.

PERFORMANCE: Now to the field. This model is a gentle flier with one purpose: training. It's also great for a very leisurely afternoon of droning through the sky. If that's your type of flying, this plane is an excellent choice.

After a pre-flight check of control-surface movement and CG (with the equipment I installed, the plane balanced perfectly with no extra weight), the Prof was ready for its lesson plan. Since I fly from a grass field, I hand-launched the plane, and the climb-out was perfectly positive—no abrupt drop or need to set a world track record to get *this* model flying!

It's important to ensure that you have a sufficient "climb corridor" when you launch the Professor. It climbs gradually; it doesn't zoom like a power plane or "balloon" like a glider; and it won't automatically out-climb, with a yank on the stick, a nearby obstruction.

At cruise altitude and throttled back, the Professor flew remarkably well, in spite of the slight breeze. Turns were great, and it banked just as smoothly as a plane with ailerons. Even though the Prof uses rudder to turn, there was absolutely no tendency for the plane to yaw and then snap into the bank. That's an important consideration for a trainer, because it teaches precise control and response.

Tucked into the belly of the Professor is a 1200mAh 7.2V battery, which is the standard kind used by many electric cars. It made the lesson a little "long-winded"; according to an observer who timed the flight, it lasted 13 minutes before the motor automatically shut down. That isn't shabby at all! (These batteries sometimes have a plastic end cap that has to be taken off so the battery will fit the battery compartment.)

Flight-proven, the Prof showed its teaching skills to the two students already mentioned, as well as to some of the local "aces." The students were ecstatic, because *they* flew most of the time instead of having to give the transmitter to me to regain control. And even when they were disoriented or dived a little in a turn, with some advice whispered in their ears, they were able to stay on the sticks and get the plane back under control. The locals were impressed with the flight time and the fact that the students progressed so quickly.

The model has quite some time on it now, and several things have become apparent. You should:

- reinforce the landing gear inside the model. The plane is relatively heavy, and the wooden blocks inside can break when landing on rough grass.
- use plenty of tape to hold the front of the thin plastic battery hatch in place, but don't block the air-cooling openings.
- from time to time, check the rubber bands that hold the motor in place. With the cowl on, you tend to forget them, but the heat from the motor can dry them out and if they break...!

OK class; now it's *your* turn to learn something from the Professor.

**Here's the address of the company featured in this article:*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

As long as the wing panels are aligned, the center-section formed plastic cover plates (top and bottom) will fit well. It's vitally important to glue these plates down firmly to the center section.

BLITZKREIG

(Continued from page 76)

air, watch the flight characteristics, and trim to suit. Replace any elevator trim with a change in stab setting, and make any rudder trim permanent by adjusting the pushrod.

While all test-flying has so far been done in 15 to 20mph March winds, it has been easy to see the plane's good performance potential. The Blitzkrieg's climb angle is good, bringing it to soaring altitude in less than 1 minute, and once there, its excellent penetration allows it to search for lift. A couple of features are noteworthy: Even near the end of battery capacity, there's still some climb left (another argument for lightness?) Its free-flight spiralling stability also adds to electric R/C flight. It's nice to be able to circle tightly without the nose dropping; you don't lose a lot of ground in strong winds. It still responds to weak lift as well as ever, and close scrutiny has found no fault with its performance.

With electric, the prescribed settings should yield a flat climb angle, at most. Experiment with up-elevator trim to find the most efficent climb angle and climb rate. I've found that this should get you to a soaring altitude in less than 1 minute. At altitude, removing the up-trim should provide the best glide and allow the use of power to go lift hunting with excellent penetration.

This account has been written in stages. I've now flown in calmer weather, and the model's anticipated potential has been realized. The new Blitzkrieg's performance is excellent! Would you believe it has taken nearly 1 1/2 years to complete this article? Meanwhile, the Blitz has flown hundreds of times, so I'm now completely familiar with it. Its soaring is excellent. A couple of times, in sky-high thermals, I didn't realize how fast it was going up and darn near lost it! Unlike with the FF originals, R/C was able to save the day, as I was able to spiral down out of the lift. The Blitz has also proven to be more than competitive with more common OT FF electric-powered designs.

I've experimented with power, especially batteries. Replacing the 1.2s with the lighter 800 size resulted in a very minor improvement in sink rate. Of course, the associated shorter motor run reduced sport flying time. Still using the Astro 05C motor, switching to 900 SCR cells produced a distinct increase in the rate of climb, and attaining altitude faster left ample power for thermal searching, in spite of the lower capacity.

A few check flights were made with the Astro 05 FAI motor and SCR cells. What a way to go!—a dramatic increase in rate of climb! With this power, the Blitz becomes a good substitute for most of the 05 contest designs; they'd be hard-pressed to out-climb it, and this certainly wasn't expected from a 50-year-old OT free flight! What more is there to say? Just have fun with an unusual design from the early years that will hold its own today!

**Here are the addresses of the companies mentioned in this article:*
***Astro Flight Inc.,** 13311 Beach Ave., Marina Del Rey, CA 90292.*
***Airtronics Inc.,** 11 Autry, Irvine, CA 92718.*
***Coverite,** 420 Babylon Rd., Horsham, PA 19044.*■

ELECTRIC FLYERS

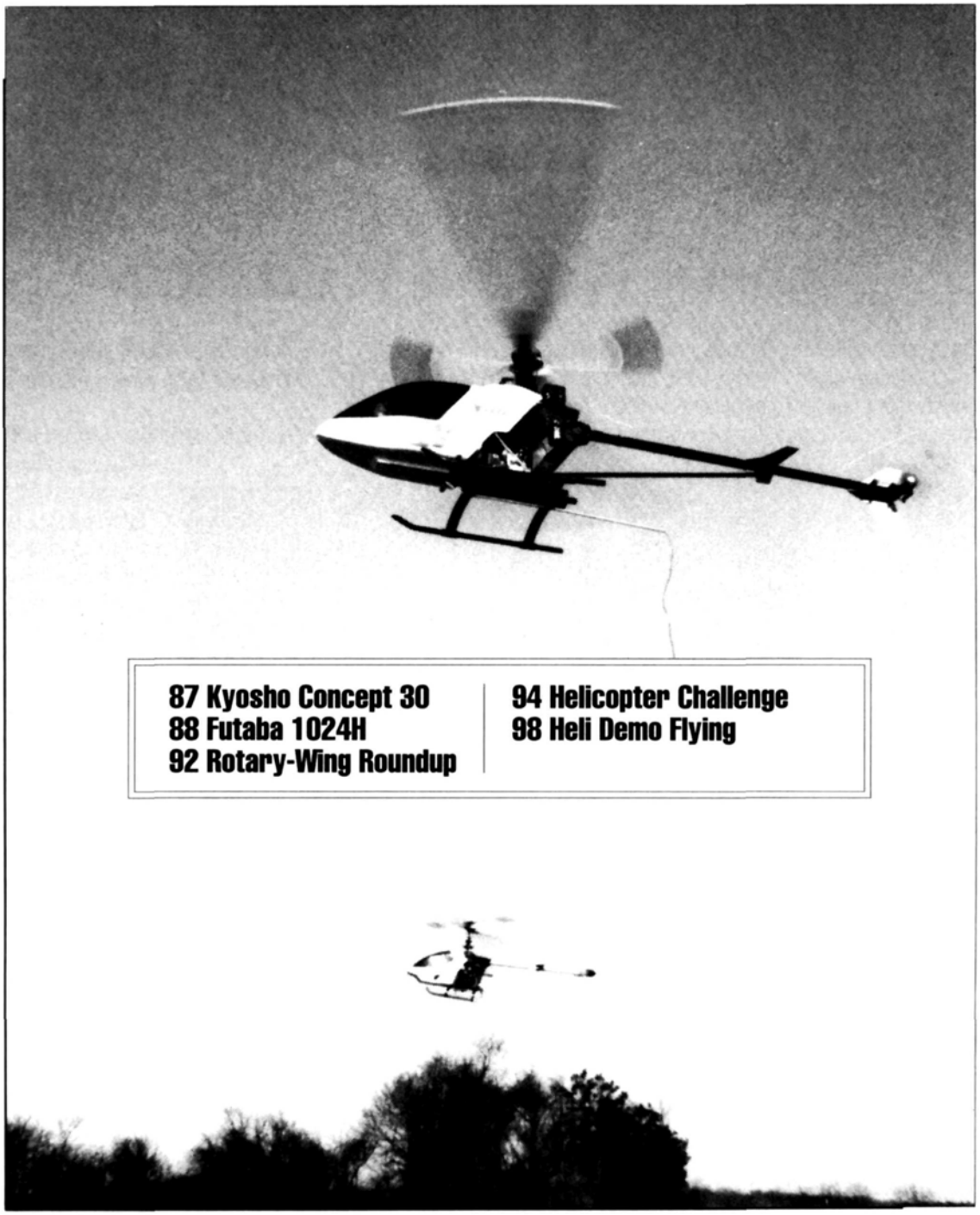
(Continued from page 61)

ference; pledge not to knock your competitors; standardize your electrical connections, advertise as a group and get

(Continued on page 102)

NEW MONTHLY

HELICOPTER SECTION



READER REPORT

KYOSHO CONCEPT 30

by SSGT. J.T. PROUTY

I'M A STAFF SERGEANT in the Air Force and have been stationed in Okinawa, Japan, since 1981. I'm the founding member and president of the AKRO R/C Club, which has both Japanese and American members. I've been flying R/C for eight years and began flying choppers in '86. The helicopters I own include a Kalt Baron 30 MX dressed up in a Bell Jet Ranger body and a Kalt Baron 60S. The Concept 30 is one of the best-flying helicopters on today's market. Whether you're a rank beginner or an advanced pilot, this bird is for you. The construction is straightforward, and all parts fit together extremely well.

The best part about the Concept is that it's virtually indestructible, and parts are readily available when you auger it in!

The plastic used in the kit is of the highest quality and it's extremely strong. I built the Concept 30 SE with the optional Hughes 300 body, which is very rugged and will withstand the hardest impact with nothing more than an occasional scratch.

Although this is an outstanding kit, it does have its weak spots, the biggest of which is the clutch/starter assembly. The stock clutch will destroy itself if the engine is accidently started backwards. Kyosho offers an optional one-piece clutch that will relieve this problem, and this new clutch is now included in the SE kits. There's also a problem with the clutch bell housing: It freezes up, and this requires disassembly and generous greasing. Again, Kyosho sells an optional bell housing that's bearing-supported, and that solves this problem.

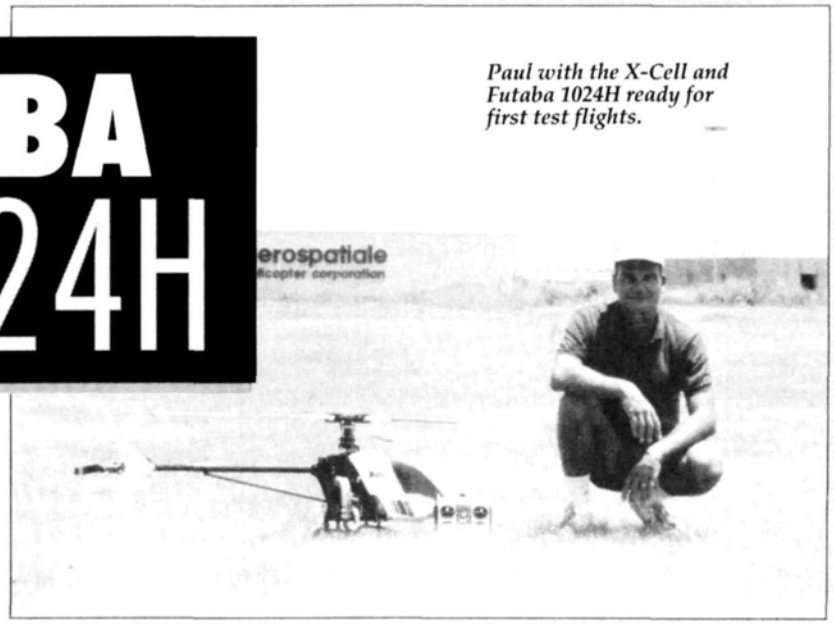
The best part about the Concept is that it's virtually indestructible, and parts are readily available when you auger it in. (Haven't met a chopper pilot yet who hasn't crashed!) I've seen a Concept driven into a paved runway from 40 feet at full speed, repaired and ready to fly again in 30 minutes. Oh, the wonders of modern plastics!

Flying the Concept is something you have to experience to believe. With the exception of hovering, it's just like flying an airplane! This is mainly owing to the CG-corrected main rotors. Loops and rolls are easily accomplished by the experienced pilot with little "fall-off" during the inverted phase. Although this bird is extremely aerobatic, it's also very stable, making it ideal for the beginner. A good friend bought a Concept 30 SE last week (his first helicopter), and he has already moved beyond hovering and into forward flight!

I think the Concept 30 SE is the best helicopter on the market today. Considering the flyability, durability and cost of this bird, it can't be beat! Although fixed-wing aircraft were my first love in this hobby, I've been moving more and more towards "helicopters only"—but only time will tell. ■

FUTABA 1024H

by PAUL TRADELIUS



Paul with the X-Cell and Futaba 1024H ready for first test flights.

PHOTOS BY PAUL TRADELIUS

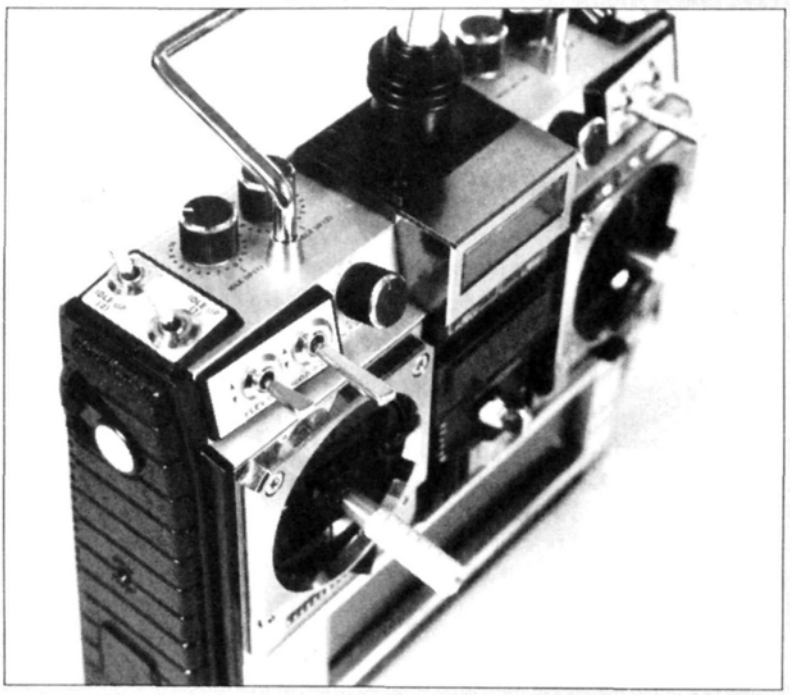
All those "bells and whistles" really are more than noisemakers!

BY THE TIME you read this review of Futaba's* latest and greatest helicopter radio, it will have been on the market for a few months, but I think it will take even longer than that to fully utilize all its capabilities. Futaba's Steve Helms sent me one of the original prototypes when it was first available last summer, and I've used it to fly several helicopters. It has so many useful features that I've yet to use them all.

Although I've been in the R/C hobby for more years than I care to admit, this review is more of a subjective, hands-on review, rather than a technical explanation of how the electronics work. Although I've never been very interested in the electronic design of radios, I am interested in their performance and what features they have for the modeler. With that in mind, I'll take a closer look at this step forward in our hobby, in a rather reverse order.

RECEIVER: This well-made receiver is light, small and has a 9-channel capacity. It works farther away than I could fly my helicopter, and its narrow-band design makes it suitable for use in future years. It worked the first time I turned it on and has continued to operate flawlessly ever since. You can't get any better than that!

SERVOS: The radio comes with five S9201 servos that accept a variety of Futaba servo arms and wheels. These servos, which are designed with multi ball bearings, a coreless motor, high torque and high speed potential, are just a smidgen longer and higher than the standard S-130 servos. They'll power just about anything you want to put into the



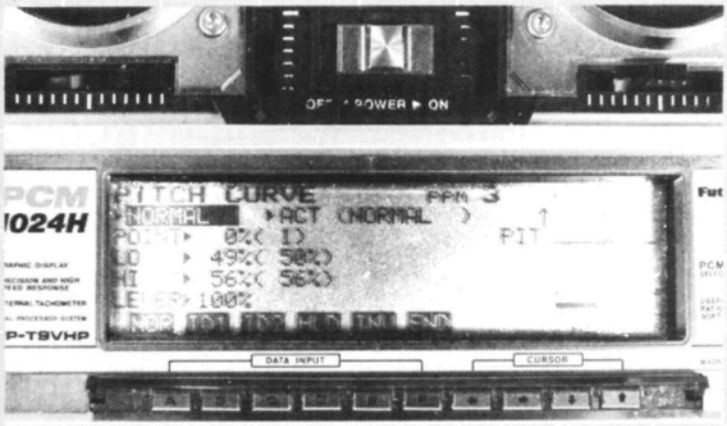
Idle-up 1 and 2 switches and adjustments are easy to reach on the top of the transmitter. Rudder and elevator dual rate and pitch trim are just above the stick.

sky. I've been doing a lot of free-style aerobatic flying with very high rotor speed, weighted blades and some high "G" loads on my helicopter, and I've never heard even a whimper from these servos.

ACCESSORIES: The radio comes complete with all accessories and is neatly packaged. A 1000mAh airborne battery is provided, and there's a suitable charger for the transmitter and receiver. A special red transmitter neck strap is included, so everyone will know what type of radio you have. A special cable going from the transmitter to the airborne switch harness enables you to operate the radio without turning it on, and that's handy when you want to make adjustments to your helicopter at a contest, or when others are flying on your frequency.

TRANSMITTER: This transmitter has so many features that it's hard to know where to begin. Although the switch functions and computer displays are very user-friendly, a detailed instruction manual is provided with a lot of pictures. To get the most out of this system, you should read the instructions *thoroughly* (even if you think you know what you're doing).

You may notice some similarities between this transmitter and the Futaba PCM 8H: The switches, trim levers and basic adjustments are all in the same places. It's great to have instant hands-on adjustments for hovering pitch, throttle trim, and high pitch trim so that you can fine-tune your helicopter. Revolution up and down mixing knobs are still on the top right, but both idle-up 1 and 2 knobs are on the top left of the TX, and that's a welcome change. The liquid-crystal display (LCD) shows, pictorially and numerically, how all the functions and sub-functions are set, and it has eight pot controls just under the output meter for quick fine-tuning .



Choosing pitch curve provides individual displays for normal, idle-up 1 and 2, throttle hold and inverted functions. Note the graph on the right that displays the pitch curve as a function of stick position.

Choosing pitch-mixing displays options for pitch curve, hovering pitch, or hovering offset.

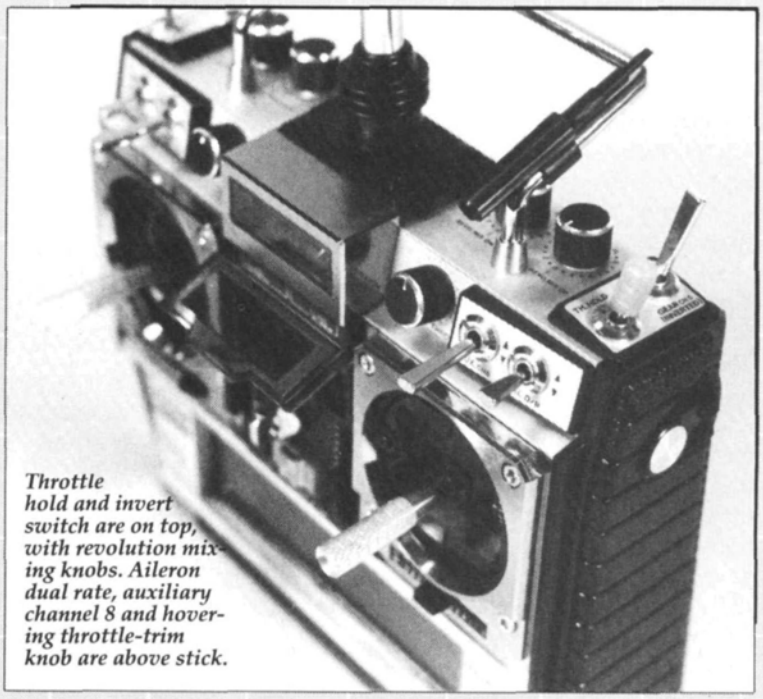
The mixing option displays the five mixing areas.

When the transmitter is turned on, the basic LCD display shows: a picture of a helicopter (with its blades turning); the name of the helicopter that you've selected; the transmitter voltage (with optional receiver voltage read-out); the integrated timer (transmitter "on" time); and a short menu of options under the helicopter. You can completely program parameters for up to six helicopters, and give a name to each one of them, using either PCM or the conventional PPM transmission method. I'm

FUTABA 1024H

currently operating three helicopters with this setup: one with the original PCM receiver, and two with conventional Futaba FM receivers. For the FM receivers, I simply installed the appropriate frequency crystal, gave the system a range check, and started flying. They all work well.

The six data-input buttons and four cursor control buttons under the LCD display are used to program the computer. A tachometer is immediately available by pressing button "C," which then shows a new screen with options for one- to five-blade rotor heads. A built-in sensor on the left side of the transmitter picks up the light reflections from the spinning blades, and a digital read-out is then displayed. Although this is a unique feature, I can't imagine it being used, since the transmitter would have to be placed very close to the spinning main rotor blades (certainly, a dangerous procedure).



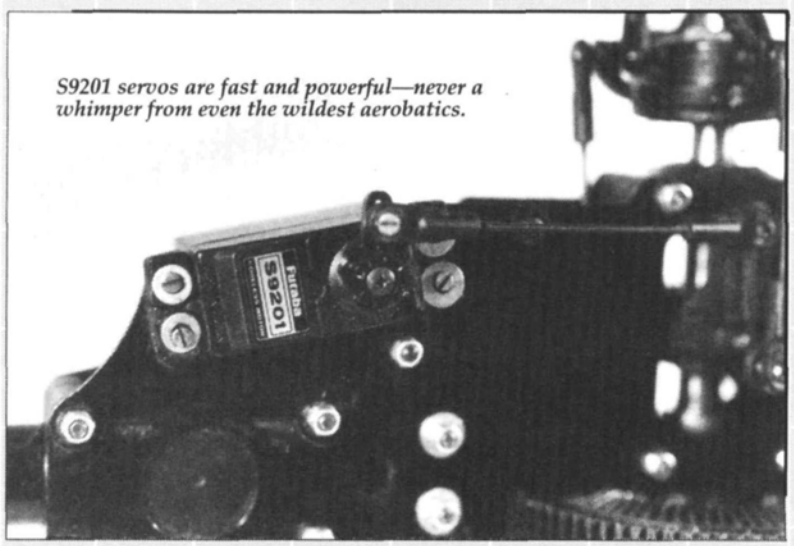
Throttle hold and invert switch are on top, with revolution mixing knobs. Aileron dual rate, auxiliary channel 8 and hovering throttle-trim knob are above stick.

The timer function is another option and is available by pressing button "B." You have the choice of an up, down, or rhythm timer, and you set the limits. This may be handy for a contest flier who's extremely time-conscious, but I don't usually use this feature that often.

The real window to the inner options of the computer is controlled by the "A" button, which is called "EDT." Pressing this button gives access to 13 transmitter sub-functions, and each has other lists of programmable functions.

Because this radio has many programmable functions to offer, it's virtually impossible to describe them all in one review. Let's just say that these initial 13 functions give you the opportunity to set servo-reversing, dual rates, servo throw, trim rates, all possible mixing functions and *even more*. I'll only discuss programming the mixing possibilities, since that's possibly the most important to us heli fliers.

Entering the initial mixing mode produces a further list of five mixing functions. A pictorial of the mixing curve is also presented on the right side of the LCD display so you can get a feel for the amount and effect of the various mixing functions. Each curve is made up of 12 points that are either smoothly adjusted by the radio, or individually adjusted by the user, if a more radical change is desired.



S9201 servos are fast and powerful—never a whimper from even the wildest aerobatics.

Throttle mixing: To set the throttle curve and hovering throttle position, the idle-up 1 throttle curve and delay, the idle-up 2 throttle curve and delay, the throttle-hold position (in either the manual or automatic mode) and the rudder-to-throttle mixing.

Swash-mode mixing enables you to operate the servos in the conventional manner via bellcranks to the swashplate, or by allowing a direct drive from the servo to the swashplate in virtually any imaginable configuration.

Rudder mixing programs right or left mixing, the amount of mixing, acceleration mixing and rudder offset.

Program mixing allows you to select any channel as the "master" and any other channel as the "slave" and have the slave channel function as a position of the master channel.

Pitch mixing allows access to the following mixing modes:

- Hovering offset to tell the radio where the throttle stick position is while hovering
- Hovering pitch, which electronically adjusts the hovering pitch and the sensitivity of the hovering pitch-trim adjustment level on the side of the transmitter, and it activates the pitch-trim knob on the face of the transmitter
- Pitch curve, which allows access to the following modes:

(a) Normal pitch curve, which allows adjustment of the high and low collective pitch, as well as the sensitivity of the high pitch-trim lever located on the right side to the transmitter

(b) Idle-up 1 curve has the same functions as above, but is active only when operating in the idle-up 1 mode

(c) Idle up 2 curve has the same as above for idle-up 2 operation

(d) Throttle-hold curve, which programs the high and low collective pitch points when throttle-hold is activated.

(e) Inverted pitch curve gives adjustments for high and low collective pitch settings, as well as an inverted trim position to adjust the pitch range with respect to the normal range.

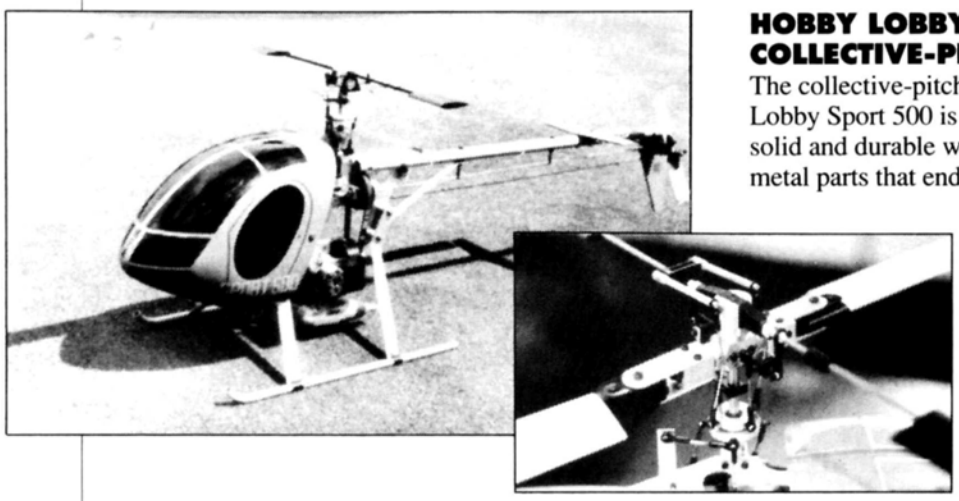
As you can see from the many available subsets of the mixing mode alone, this radio lets you program just about anything to make your flying more precise, easier and more enjoyable. And, just to make sure you have enough hands-on capability, a small panel just below the transmitter output meter has an additional eight conventional adjustment pots so you won't have to enter the computer to make small changes to critical adjustments.

A small screwdriver is attached to the carrying handle so that you can make quick adjustments of rudder-to-throttle mixing, throttle hold, rudder offset, low pitch for idle-up 1 and 2, throttle hold high and low pitch and normal low pitch.

Although I've only had this radio for a few months,

(Continued on page 136)

ROTARY-WING ROUNDUP



HOBBY LOBBY COLLECTIVE-PITCH CONVERSION

The collective-pitch conversion for the Hobby Lobby Sport 500 is constructed in the same simple, solid and durable way as the helicopter. It uses metal parts that endure mishaps, and, unlike plastic heads, this head can be lubricated and maintained. The kit is easily installed on the Sport 500 to provide more prompt control response for more enjoyable flying.

For more information, contact Hobby Lobby, 5614 Franklin Pike Circle, Brentwood, TN 37027.

AIRTRONICS QUANTUM

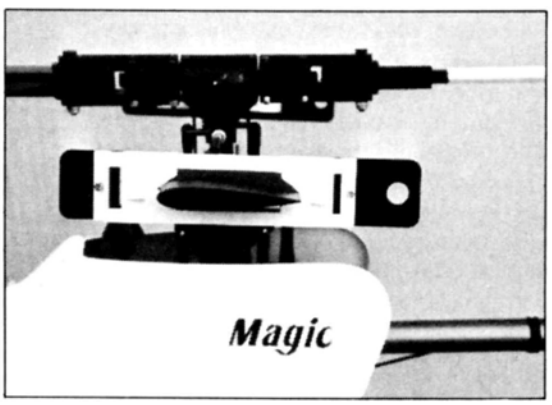
Quantum is Airtronics' world-class professional R/C series, designed specifically for pattern aircraft fliers and competition helicopter pilots. Quantum gives you fully programmable transmitter features for customized system flexibility. The Quantum QM8P/PCM is refined and engineered for superior F3A flying, and the QM8H is especially designed for highly maneuverable F3C flight. The Quantum series radios feature: plug-in RF module; Pulse Code Modulation; cartridge-style plug-in battery; electronic trims; exponential or linear control on aileron; elevator and rudder; LED indicators; high-capacity Ni-Cd; liquid-crystal display with bar-graph meter and integrated timer; and much more.

For more information, contact Airtronics, 11 Autry, Irvine, CA 92718.

ROBBE PADDLE ADJUSTER

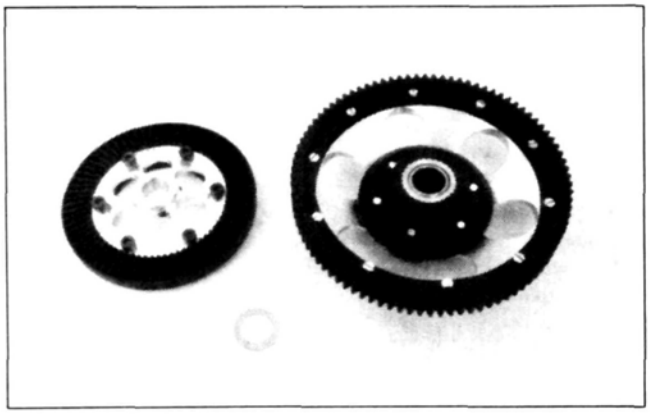
The control and flight behavior of an R/C helicopter with a flybar depends on the exact adjustment and alignment of the control paddles. The demand for accurate alignment led to the creation of this adjustment device. It's clamped to the paddles to allow precise alignment ,which will result in more responsive, predictable flight.

For more information, contact Robbe Model Sport, 180 Township Line Rd., Belle Mead, NJ 08502.



O.S. ENGINES .32 F-HX W/RECOIL STARTER

O.S. Engines offers the power, performance and reliability of the .32 F-HX with the convenience of an easy-to-pull recoil starter. A 3H-type carb and Schnuerle porting provide the power modelers appreciate in a .30-size engine. Designed for the Hirobo Shuttle (not compatible with the Concept 30), this new pull-starter makes engine starting a breeze. For more information, contact Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.



MINIATURE AIRCRAFT CONSTANT DRIVE

Miniature Aircraft's constant-drive tail-rotor system is a must for FAI competition. This unit uses a modified tail autorotation unit along with precision-ground split gears to provide full-time tail drive. Owing to the precision-machining process, this unit runs more smoothly than a standard system!

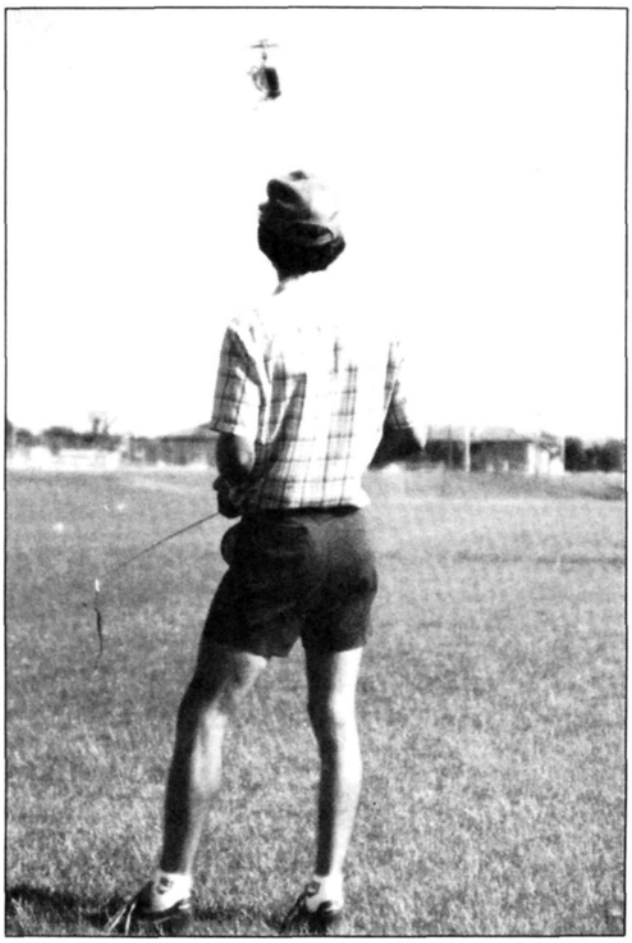
For more information, contact Miniature Aircraft, 2324 North Blossom Trail, Orlando, FL 32804.

FUTABA GYROSCOPIC STABILIZER

The Futaba G154 gyro is an economical and compact rate gyro designed for novice and sport helicopter pilots. In addition to its low cost, the G154 (G134 for standard Futaba 3-pin connectors) features a new, lightweight, two-piece design for easy installation and low current drain. For power, the unit requires 20mA for the amplifier and 100mA for the motor, at 4.8 volts. The body of the gyro measures 1.57x1.65x1.60 inches, and the amplifier measures 1.06x1.89x.63 inches with a total system weight of 3.6 ounces. For more information, contact Futaba, 4 Studebaker, Irvine, CA 92718.

Helicopter Challenge

by CRAIG HATH



Tom Hart brings his machine to a stop right in front of him to hover nose-on. Nose-on hover isn't as difficult as it seems—if you analyze the elements pointed out in the article.

OVER THE PAST few months, we've covered some advanced flying skills, e.g., loops, rolls, stall turns, autorotations, etc. Before we head off to another subject, we should touch on two more areas of advanced flight: nose-on hovering and inverted flight.

Just the mention of nose-on hovering sends chills down the spines of many pilots, even though they're probably well-versed at flying nose-on in forward flight and through the landing approach. There's really nothing to fear, however; nose-on hovering will be much easier when you have some basic thoughts programmed into your mind. First, you must know that the control response for pitch and roll cyclic, as well as tail-rotor pitch, are *reversed* as the nose is turned in toward the pilot. In other words, the commands that are put in through the radio will cause the helicopter to react in the opposite way to how it would react if the nose was pointed away from the pilot.

When hovering nose-on, two simple thoughts keep me out of trouble. First, I watch the *tail* of the helicopter and tell myself that it's the *nose*, and this returns the tail-rotor pitch control to responding as it would while hovering nose-out. Second, I tell myself to prop up the low side of the rotor disc by pushing the control stick toward the low side of the disc, so the roll cyclic commands will always be correct for leveling the machine.

These two thoughts let me concentrate on flying the fore-and-aft cyclic, which is now the only control that really seems backwards. In effect, I've reversed the other two flight controls in my head. When you've practiced the nose-on hover for a while, you'll begin to react naturally, and you won't need to *think* about giving the correct control.

As he moves through a hovering nose-on circle, Tom displays the amount of concentration needed for precision nose-on work.

When you're ready to learn to fly nose-on, start with the helicopter sitting on the ground with it's engine off. Imagine the helicopter hovering, nose-on, a few feet off the ground, and pretend to fly it with the transmitter. Are you making the right corrections to hold the machine in a steady hover? Continue this for 30 seconds to a minute. Now fire up the

HELICOPTER CHALLENGE

Left: Getting used to the reversed control reactions from hovering nose-on can be simplified by using a couple of the author's nose-on-hover thoughts.
Below: For some fliers, the hardest part about flying nose-on is getting up the nerve to try it, even though many of them are used to looking at their helicopter from this perspective while in forward flight and through the landing approach.

machine, set it back out on the ground with the nose pointed into the wind and stand in front of the helicopter. Lift it up until it's light on the skids, and try to get the helicopter to stabilize in a level position. You're learning to hover all over again, but you'll find that the learning curve will be much sharper and shorter because you've already trained the muscles in the fingers for the proper eye/hand coordination needed to hover nose-out. You only have to get used to looking at the helicopter from this new perspective. As you become more confident, lift the helicopter up a little higher until you can hover for extended periods at 2 or 3 feet off the ground.

There are two distinct stages of learning to hover nose-on: One is the actual hover; the other is the transition from nose-on to nose-out. As you work on hovering the helicopter nose-on, focus on keeping the helicopter under control, and then work on moving it around as soon as you feel comfortable.

When you're confident with your progress, try turning the nose away with tail-rotor pitch until the helicopter is nose-out. Learn the transition from nose-on to nose-out before stepping right in to bringing the nose back on. As you rotate the nose of the machine away from you, you'll notice that there's a position where you mentally switch your control reactions from one mode to the other. You can really feel this at first; it's even a little unnerving! Don't fight this reaction, as you have to become comfortable with the transition.

You might also notice that you occasionally rotate the nose away from you, so that you're *flying* nose-out but still *thinking* nose-on. If this happens, you're giving the helicopter backward commands. The only way to help prevent these situations is through practice—the more, the better. I prefer to practice with at least a slight breeze, as this will help to keep the tail steady; it also requires you to hold just a little fore- or aft-cyclic pitch to stop the machine from drifting.

To help you change into and out of nose-on, practice slow pirouettes one way and then the other, letting the helicopter spin slowly around its yaw axis. Pirouettes allow you to practice all aspects of the hover, as you'll find that cyclic-pitch corrections are needed to prevent the machine from wandering off to one side or another. Naturally, the better your machine is set up to hover, the easier the learning process will become. Regardless of your equipment, keep working at it, and you'll be amazed at how well you'll do in a short time.

Inverted Flight

This subject is sure to raise an eyebrow or two among heli pilots. There are two schools of thought about inverted flight: The first deals with setting up the machine so that, when it's rolled on its back, a switch can be selected on the transmitter that reverses collective pitch, fore and aft cyclic and tail-rotor pitch, so that the helicopter can be flown just as if it were upright. The second theory is that the collective pitch and throttle are set up so that, as

(Continued on page 136)

HELI DEMO FLYING

The techniques and maneuvers of the experts

by DATU RAMEL

I'll TELL you about some of the inspirational flying I saw last spring, but I want to do it in the context of the flight-description conventions for which I've campaigned in my helicopter columns.

High standards for describing maneuvers are essential for high standards of piloting. A concise language of flying, and by that I mean the eyes-brain-hands-sticks part, as opposed to the electronics-linkages-aerodynamics part, can accomplish several things:

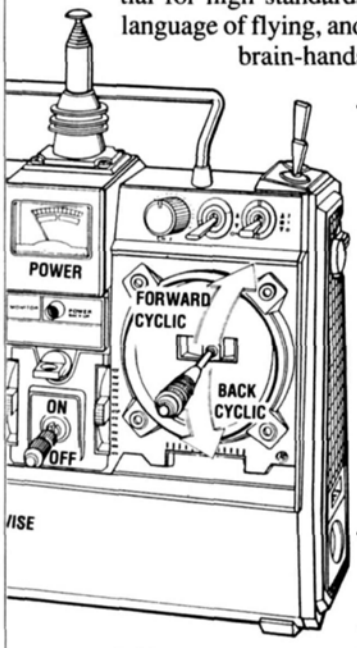


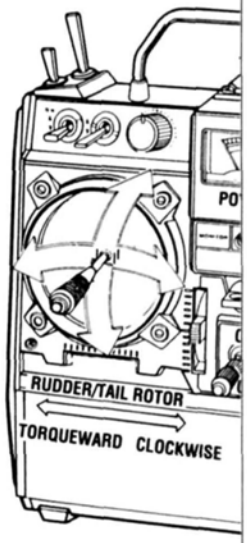
Fig. 1 Applicable terms for degrees of fore/aft cyclic (elevator) input

SHOVE	radical deflection for somersaults
TUCK	decisive deflection for outside loop or vertical dive
PUSH	medium deflection for dive or fast descent
FORE	slight pressure for forward flight
NULL/NEUTRAL	
AFT	slight pressure for tail-first flight
PULL	medium deflection for climb or loop
FLARE	decisive deflection for ending an approach
YANK	radical deflection to avoid objects and planets

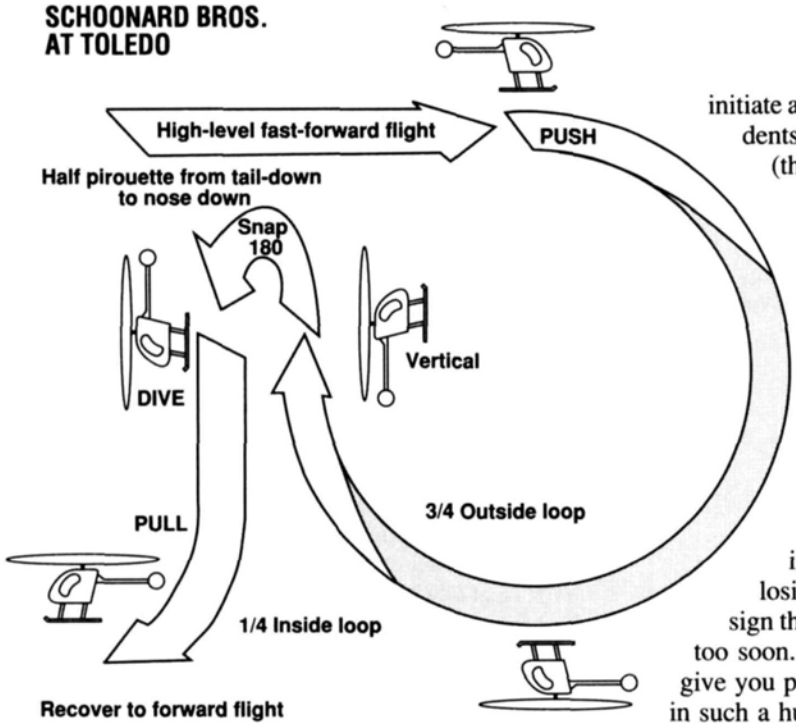
- We become more precise when discussing our sport. The sheer difficulty of learning and the mesmerizing aspects of hot-dogging can foster a black-magic approach to flying model helicopters. If we give "halos" to a handful of pilots without "deciphering" exactly-what they do, then we might as well never ask them how they do it. Understanding what these pilots do moves R/C heli flying from sorcery to science; from "I wonder if we'll ever see that again!" to repeatable experiments in the sky. With blades CG-corrected to the gram and centimeter, servo throw repeatable to a fraction of a degree, and pitch adjustable to one part in a couple of hundred, the hobby suffers no lack of precision; but the sport lags far behind. "He flew a nice loop." "He flew a nice rolling stall turn." Watching the Team Selection contestants try "top hats" and RSTs in front of the FAI judges makes you think that there's a richness in the "nice" parts of maneuvers that deserves our best, most accurate descriptions—especially when we consider that each flier is doing very specific things at the controls to make his flight look "nicer" than the next person's.
- We can think-through maneuvers as if we were flying them—visualizing or rehearsing; putting all the little what-to-dos in a sequence that you and

Fig. 2 Applicable terms for degrees of throttle/collective input

100% throttle	8°	**PUNCH**
70-90% throttle	6°	**GAIN/CLIMB**
60-70% throttle	4°	**HOVER**
50-60% throttle for forward flight	2°	**POS**
for slow descents or transition to inverted	0°	**FLAT**
for inverted segments	-1° to -2°	**NEG**
for prolonged inverted	-1° to -4°	**SIP**
for rapid sink or winding up the head for autos	-2° to -6°	**DROP**



SCHOONARD BROS. AT TOLEDO



someone else can understand and remember will lead to better flying. Teaching a less experienced pilot how to execute and improve a maneuver is the best test of whether you're actually flying the maneuvers or just going along for the ride.

• We create learning tools, whether we're learning ourselves or teaching others. If experienced people and novices can agree on the right words, then in-flight coaching becomes practical. The Panic Quadrant of Cyclic is as vaguely known to the beginner as Right Hand Towards Navel. If we help the novice associate desired control inputs and flight behavior with specific command words, he'll fully appreciate the many useful things he can do by pulling on the elevator stick:

Aft means a little back pressure on cyclic, initiates tail-first motion from a stationary hover, or reduces air speed when in forward flight (FF).

Pull describes a little more back stock, say one-quarter deflection, and this visibly drops the tail in the hover or starts a shallow climb when in fast forward flight (FFF).

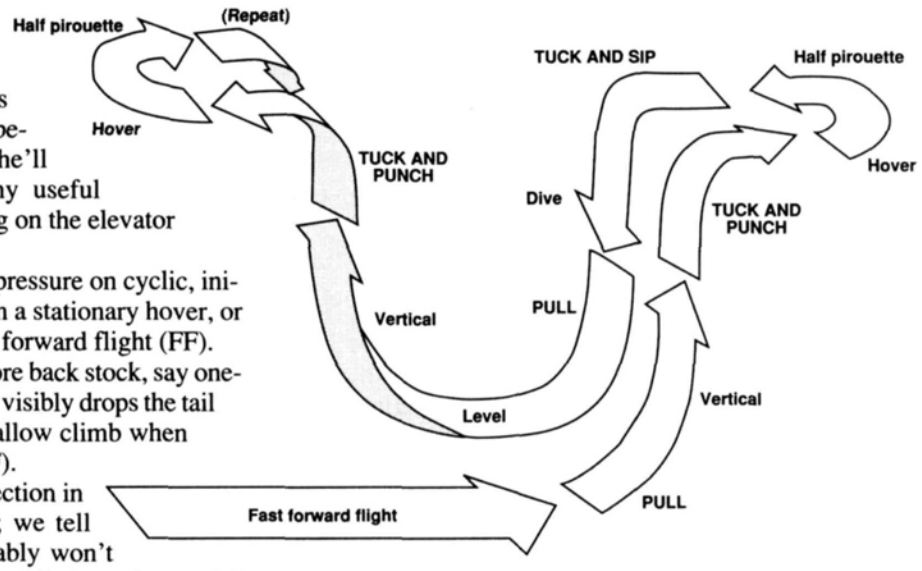
Flare refers to half deflection in the up-elevator direction; we tell our pupils that they probably won't use this much back cyclic while hovering, and that a healthy pull or flare command issued during FFF can initiate a stall turn or loop. We instruct our students not to try radical cyclic deflections (the ones beyond half-back stick) unless we yell "grab," "yank," "pull-out," or something suitably urgent.

If students have been doing their homework, we can take the time to explain that radical elevator commands, for either aerobatic or save-the-ship purposes, will require some coordination with the left half of the radio and its command words.

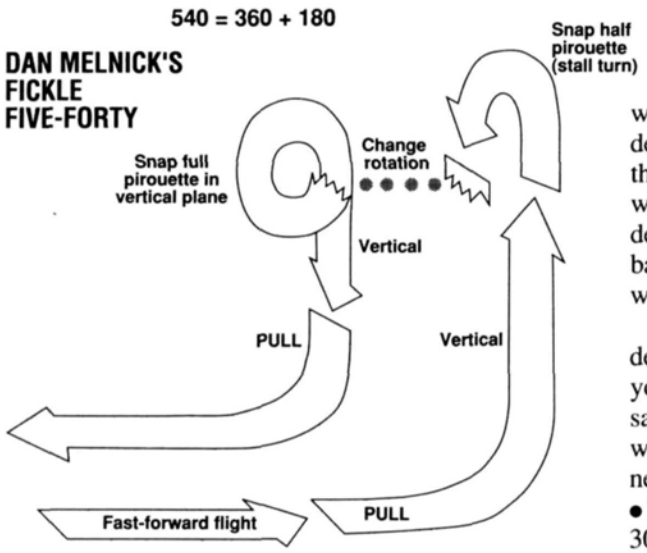
"Junior, the blade slap you hear pulling out of those figure 9s means you're losing valuable head speed, and it's a sure sign that you're gaining too much collective too soon. Your gravity-induced air speed will give you plenty of translational lift, so don't be in such a hurry to give high left stick when you PULL cyclic. Just FLATTEN the blades to near-zero pitch, and fly the exit with something more than PULL, but less than FLARE at your right hand, OK? Remember, the recovery as you come through VERTical is FLAT—we've agreed that that's a left-hand command to go for null pitch—while PULLING on the right stick. Don't try for a collective GAIN—another left-stick specific word—until you've returned to LEVel FFF in the horizontal plane."

With this example, I've hinted at some desirable characteristics of a flight-description language:

Use monosyllables that indicate the degree or ur-



ROBERT GORHAM'S SKATEBOARDER HALF-PIPE REVERSALS



gency of stick deflection (Fig. 1). Think of the elevator control as having the following settings from full forward to full back—SHOVE, TUCK, PUSH, FORE, NEUTral, AFT, PULL, FLARE, GRAB, YANK, PULLOUT. TUCK initiates a nose-over to start a dive or outside loop, while SHOVE points the nose earthward very, very quickly. Hot-doggers use the same SHOVE setting (full down elevator) in conjunction with well-timed LOSing or SIPping of pitch to do forward tumbles or somersaults.

Don't assign the same word or same-sounding words to both transmitter sticks. Instead of saying neutral/middle TC and neutral/middle cyclic, say HOVER or FLAT for half-stick TC (depending on your pitch curve) and say NULL or NEUTral for center cyclic so there's no confusion between hands.

Use concise terms that minimize ambiguity. TORQUEwise means a tail-rotor command that rotates the bird counterclockwise, and you don't have to worry about whether the nose or the tail is going left. Thinking PUSH and not saying "loop" when you start a loop means the maneuver will be an outside loop whether you start it upright, inverted, or vertical.

Associate one or two command words with the logical elements of aerobatic maneuvers–usually segments of at least 90 degrees rotation about one of the axes. Distinct segments of a maneuver are where a judge looks for downgrades from what he considers perfect execution. For example, an experienced observer grading a loop looks for flaws not only in the overall shape of the maneuver, but also in each of the four 90-degree arcs. PULL VERT from FFF describes the first quarter inside loop that points the nose up and away from the horizontal plane. The second quarter loop that gets the helicopter belly-up requires less back cyclic as well as some negative collective pitch, so we can say EASE PULL or AFT and FLAT, NEG, or SIP collective to go INVerted.

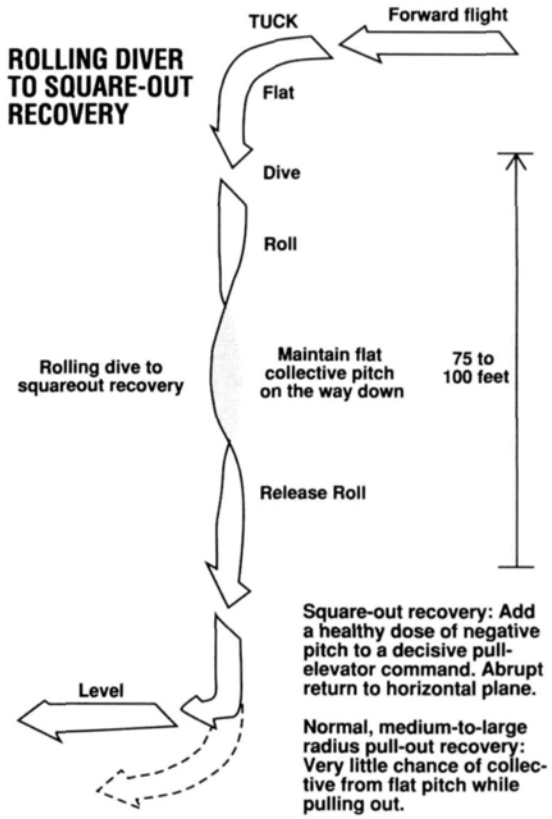
Mention conditions that affect the maneuver: usually whether entering the maneuver up, down, or crosswind, as well as the entry altitude and speed. The best demo pilots plan their maneuvers and turn-arounds so that there's something to watch on every flyby, downwind or upwind. The best FAI pilots can make tactical decisions about which way to approach for an aerobatic maneuver, while they're flying the pattern if the wind and light (visibility) combinations change.

Here are some notes that I made during some recent demo flights. (Monosyllables are very handy when you're watching holes bored in the sky and trying to say or write down a dozen things in three seconds, which is the duration of a typical crowd-pleasing maneuver.):

- The Schoonard brothers, showing off the new X-Cell 30s after hours at the Toledo Show: HIGH level FFF, PUSH 3/4 Outside Loop to VERTical, SNAP 180 (HALF PIRouette) in the vertical plane to NOSE-down VERTical DIVE, PULL 1/4 Inside Loop Recovery to Fast Forward Flight.

l Robert Gorham in Dayton after the Team Trials: His Skateboarder's Half-pipe Reversals, or you can call them Figure-Us linked with Half Spins. From FFF PULL nose up VERT, TUCK and PUNCH collective to a quarter NOSE-over back to a HORIZontal HOVER, PAUSE, SNAP HALF PIRouette (180), TUCK and FLAT or SIP (negative) collective to do a quarter NOSE-over to DIVE, PULL to LEVEL, then PULL VERT to REPEAT.

- Dan Melnik's Fickle Five-Forty, the Stall Turn that



changes its (pirouetting) mind, also seen at Dayton: From FFF PULL VERT, SNAP 180 (HALF PIRouette) at the top to NOSE-down, immediate SNAP 360 of opposite rotation (reversing the PIRouette) to return to NOSE-down VERTical DIVE, PULL recovery. Dan also performed some thrilling Autorotating Death Spirals from what Cliff Hiatt calls "nosebleed" altitude; Dan got his Excalibur high enough for 10 steeply banked Spirals—once you're happy with the roll, or bank angle, you can adjust the rate of descent with the elevator and negative pitch controls—that the spectators helped him count out loud.

• Rolling Diver to Square-out Recovery. This maneuver invented itself with very little help from me, when Al Schneider let me fly his very agile Concept 30 SE. The first time the helicopter did it, I wasn't sure what I saw or how the machine pulled it off without a mishap. I thought for a second and the name Square-out came to mind, because of the sharp corner in the flight path at the end of the maneuver. I went right back up to entry altitude to talk the helicopter through it a second time. The command words for the Rolling Dive part were already familiar to me, thanks to the British pilot John Wallington's articles on the Roll and its variations: TUCK into a VERTical DIVE and ROLL (AILeron) RIGHT while setting collective to FLAT or zero pitch. My first recovery from the Rolling Dive to horizontal with Al's C30 was a shock, because I had no idea his elevator control was so responsive. All I did was breathe on the stick and the Kyosho snapped through 90 degrees of attitude change with nothing resembling a curved pull-out, looking more like a UFO than an aircraft. On this second try, I knew I would RELease or EASE the RIGHT cyclic to stop the roll, then I would decisively PULL (more than AFT) cyclic to leave the vertical plane. I wasn't sure what I should do with the left stick, but I reasoned that giving NEGative pitch while the tail boom was rotating down would accentuate the abruptness of the attitude change and give me the square corner look that I wanted.

I pieced the phrase together in my mind once more before the dive: TUCK, DIVE, FLAT, ROLL RIGHT, RELEASE(ROLL), SIP NEG & PULL, LEVEL forward flight. I saw it, I said it, and the heli did it! Al and I wondered why we hadn't seen this before, and we concluded that the low mass and resultant light disc loading of the Concept 30 makes this kind of violent attitude change easier than with a 60 ship. Will the first person who does this with an X-Cell or Magic tell me what happens? ■

ELECTRIC FLYERS

(Continued from page 82)

better rates; supply "electric" decals at cost; develop a consumer membership; supply distinctive lapel pins to those who can verify that they've flown solo. Offer VCR programs to local TV stations; get on "*60 Minutes*"! Show that the entire family can have fun with this great hobby.

• To magazine editors I say: You're devoting a little more space to electrics than you did six months ago, but if readers are interested in electrics, why make it so difficult to find the information. Set aside a special section for electrics—a place where glow plug, fuel and engine-starter advertisements aren't permitted. Before you know it, you may find it feasible to create a spin-off publication.

So for an investment of about $250 bucks, this old-timer is back. I've already had a great deal of enjoyment, and I haven't even "soloed" yet. This investment is peanuts compared with the amount I spent on ham radio and the computer. I have a lot to learn; I just wanted to give you a look at electrics from the perspective of an enthusiastic newcomer. I'm charged!

**Here are the addresses of the manufacturers mentioned in this article:*
Leisure Electronics, *11 Deerspring, Irvine, CA 92705.*
Cox Hobbies Inc., *1525 East Warner Ave., Santa Ana, CA 92705.* ■

CHARGE!

Get the most from your Ni-Cd Pack

by STEVE POND

This is the new Sanyo 1700mAh cell that has become very popular with R/C cars. It offers about 33 percent more capacity, which translates into longer flying times, but they can't take the beating the 1200s will.

WHEN WE DECIDED to prepare a special "electric" issue of *Model Airplane News*, I was asked to write an article about the proper charging, use and discharging of Ni-Cd batteries. I don't claim to know all there is to know about battery charging, but my years of experience with R/C cars have given me opportunities to experiment with many varieties of nickel-cadmium (Ni-Cd) cells and their applications. While flying electric model airplanes and racing R/C cars might seem to be worlds apart, their Ni-Cd batteries are essentially the same.

For the most part, an R/C electric plane using a popular 540-type motor is capable of 5- to 6-minute flights when using a 7.2V, 6-cell 1200 mAh pack as its power source. This translates into an average current draw of roughly 12 amps. Although the high-performance cars to which I'm accustomed drain the batteries in 4 minutes at a higher amperage rate, both applications discharge the batteries at a rate that's well in excess of that for which the cells were actually designed. This rapid rate of battery discharge demands some special handling, both when charging and after use.

Although there's a tremendous variety of cells available for use in model airplanes, I'll focus on the sub-C-cell Sanyo* Ni-Cds, because they seem to be the most widely used. Other brands are very similar in charge/discharge characteristics, so this information applies to them also.

The Chargers

While electric flight is touted as being easier than the seemingly more complex and noisy gas-powered flights some choices face newcomers, including what type of charger he or she should use. There are three primary types of battery chargers:

- trickle chargers
- timed quick-chargers
- peak-detection chargers

Each charger has merits, but for charging the main pack that powers your plane, certain types have obvious advantages. Standard trickle-chargers have been around for some time and have been proven effective and safe, but the time required to charge a battery with this type of charger makes them impractical for field use. For example, to charge a 1200mAh pack at the standard rate (C10), a 120mAh trickle-charger can take anywhere from six to 16 hours, depending on the pack's residual charge. Owing to this low rate of charge, this method is very safe, but the plane's motor can consume this charge in only 5 minutes. Unless you have many spare packs and just as many trickle-chargers, your day at the field could be a *short* one.

The second type of charger is the timed fast-charger. Owing to its higher charge rate, this type is more suitable for field use, and most fast-chargers are capable of charging a depleted 1200mAh pack in 15

to 25 minutes. This will allow you to use fewer battery packs than if you were trickle-charging, and you can usually recharge a dead pack in less time than it takes to put your pin back up on the frequency board.

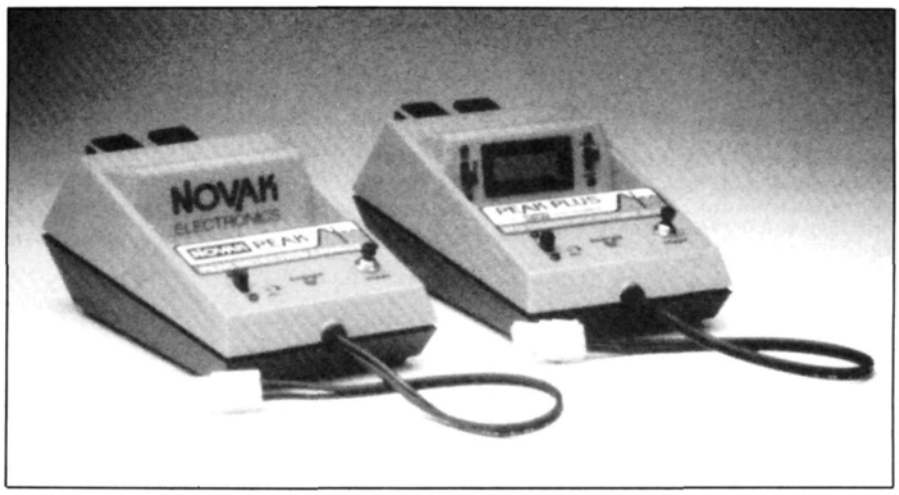
The *disadvantages* of this type of charger are that it charges at a fixed, *high* rate, and it can't tell when a battery is fully charged; it simply shuts off when the timer unwinds. This isn't a problem when charging a dead pack, but if your battery still has half a charge in it, there's a distinct possibility that it could overheat if left unattended. Unless you're sure that the battery is completely discharged before charging, you should check the battery to see if it's getting warm. Heat is a good indication that the battery has reached full capacity, and any further charging could lead to damage.

If the charger operates at less than 4 to 5 amps, however, it will take longer than 15 minutes to charge a dead 1200 pack, and even longer for the new 1700 packs. The result will be a reduced flight time owing to an insufficient charge. Check the batteries periodically to ensure a *full* charge, not an *over*-charge. For a dead battery, it might take twice around the 15-minute dial on the charger to obtain a full charge. The time it will take to reach full charge is, once again, determined by the amperage the charger can put out. As mentioned before, when the pack starts to get warm (not hot), it has reached full charge and should be removed from the charger.

The third type of charger is the peak-detection variety, which, technically, is the most advanced charger and will provide you with the best, most controlled charge possible under most circumstances. The peak-chargers sense when a battery has reached capacity by monitoring the voltage of the pack. When the voltage starts to drop, the charger will shut down, leaving you with a battery that's charged to capacity, regardless of the state of charge when you started. Many of them switch to a "trickle" mode after peak-detection, and that's another nice feature.

The flexibility and capability of this type doesn't come cheaply. As you'd expect, the best peak-chargers are considerably more expensive than the other types discussed, so to determine the type of charger that suits you best, you must weigh what you can spend against the performance you want.

This Pro Charger from World Engines is a typical 15-minute fast-charger. It comes with an ammeter, trickle-charge mode, 15-minute timer and, on the more expensive versions, variable charge rate.



These Novak peak chargers are typical of the high-tech peak chargers. These chargers will consistently produce a full charge without having to check the battery, although it isn't recommended that you leave the battery unattended while charging.

Cells

Battery type shouldn't concern new modelers who are concentrating on flying rather than on how to get an extra 30 seconds out of their packs. Even if performance isn't a concern, however, certain charging and discharging techniques are unique to certain types of cells. Understanding and using these will help ensure a long-lasting, high-performance pack.

Until a few years ago, only one type of cell was used by modelers—the "SC" cell. This is a 1200mAh workhorse that's still the most widely used. These cells take a good charge on any of the previously mentioned chargers, but there are ways to obtain the *best* results.

When charging the SC cells for use in an electric airplane, it's best to keep the charge rate in the 5- to 6-amp range. This rate of charge will yield the best results when being discharged at a rate of approximately 12 amps. Charging is best accomplished just before installing the pack in the plane, but you can charge them overnight and "peak" the pack at the field.

These are Sanyo's new high-capacity cells. The SCR cell has a 1500mAh capacity, and the SCE has a 2000mAh capacity. They're the same diameter as the cells we're used to, and they're 7mm longer, which should be ideal for some airplanes.

To "peak" a pack means to hook it back up to the charger just before use and then let it go until the pack gets warm, or (in the case of a peak-charger) until the charger switches into the trickle mode.

For best results, allow the pack to cool between the initial charge and the peak charge, and after using the pack, let it cool for an hour or so before recharging to allow the heat and internal resistance of the cell to return to normal.

SCR Cells

The 1200mAh SCR cells recently introduced by Sanyo are similar in capacity to SC cells, but they produce a higher voltage and allow a more rapid discharge when you really pour the power on. These cells are also considerably more durable than any of the other available cells. Many have found that these cells work best when charged at a rate of 9 amps—right! 9 amps! With thicker insulation between the plates, these cells allow for this high rate of charge. If your charger is capable of providing this amperage rate, it won't only produce the best results, but it will also greatly reduce the charging time. These cells should also be allowed to cool before recharging, but they can be recharged when they're still warm, if necessary.

SCE Cells

The SCE cells are the latest from Sanyo, and they offer about 33 percent more capacity in a cell of the same size. The sub-C size SCE is rated at 1700mAh with a typical capacity of about 1800mAh, but these cells are considerably more delicate than the SCR or SC cells, so you should take some precautions.

When charging SCE cells, don't charge

(Continued on page 139)

Product News

PARMA ELECTRIC PLANES

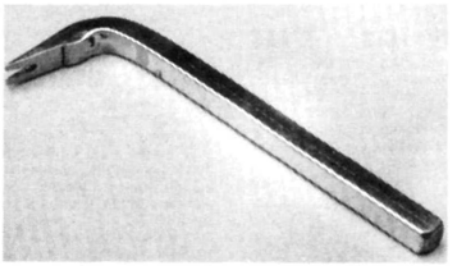
Parma takes to the air with these two sport/trainer electric aircraft. On top is the Aero-Tiger, which is perfect for those who enjoy building a precision kit as much as they do flying one. It comes in both basic and deluxe versions. Also shown is the Aero Sprint, which shares the same gentle flying characteristics as Aero-Tiger, but all major assemblies come pre-built. It's almost ready to fly! No. 25000 Aero-Tiger Basic Kit, $59.95; No. 25100, Aero-Tiger Deluxe Kit, $160; No. 25500 Aero-Sprint ARF, $149.95.

For more information, contact Parma International, 13927 Progress Pkwy., North Royalton, OH 44133.

MPE TECHNOLOGIES BATTERIES

A new high-capacity battery, the Avenger SCE, offers radio-control enthusiasts all the power they expect from battery packs with the SCR construction, but with much longer run times. The features of the Avenger SCE include 1600mAh typical capacity and the ability to charge and discharge rapidly. Maximum power is available to the motor for longer running times at maximum voltage. The Avenger SCE is assembled using computer-matched and graded cells, and it features low internal resistance for high current discharge.

For more information, contact MPE Technologies, 15125, S.W. Koll Pkwy., Building 4G, Beaverton, OR 97006.



REYNOLDS JEWELRY CLEVIS REMOVER

The Clevis Remover is specially designed for situations where the clevis is located in a very tight spot within the fuselage. It also removes arms from servos and removes servo plug-ins on Futaba radio receivers. Simply insert the Clevis Remover between the servo arm and the clevis, then tilt to the right or toward the threaded part of the clevis. Each tool is hand-made and engraved with the purchaser's name.

For more information, contact Reynolds Jewelry, 1707 Carter St., Vidalia, LA 71373.

KMI GLOWBOX

The KMI Glowbox, model GB-1, has been specially developed to power glow plugs from a dual-cell, series-wired, 1.4 amp/hour Ni-Cd pack. These provide long life with ample voltage to clear flooded plugs and provide power for 1.5 to 2.0V types. The circuitry uses a semiconductor to control the voltage at the plug and a meter that indicates the plug's status. The power pack has a modular connector that allows for a variety of plug leads and is the charging input from the separate wall charger. The pocket-size ($3^3/_4$x$2^5/_8$x$1^1/_2$ inches) high-impact plastic case has a protector over the on/off slide switch. The Glowbox is supplied with a standard Pozzi-Klip and the wall charger. Price: $54.95.

For more information, contact Kraft Midwest Inc., 115 E. Main, Northville, MI 48167.

KYOSHO EXPRESS

With parts manufactured so accurately that they assemble without adhesives, the new 61-inch wingspan Kyosho Express ARF provides an easy ticket to motor-gliding enjoyment for intermediate fliers. Based on the aerodynamic design of the Valencia, the Express offers excellent wind penetration, balance and lift, thanks to the proven Eppler airfoil, generous dihedral and the high T-tail. Pilots can also achieve off-the-ground takeoffs with the included LeMans AP29R motor and gear-reduction unit. The blow-molded ABS fuselage and crash-resistant OHS wings come pre-covered for a brilliant finish. The molded-foam T-tail is removed easily for transportation. Molded cowling, linkage, Kyosho's special auto-cut-off circuit, built-in pilot figure and decals are also included.

For more information, contact Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

CENTURY SYSTEMS FAILSAFE

If your radio signal fails for any reason, the Failsafe takes over and runs the servos to a pre-set position that you set. When the signal returns to normal, the Failsafe resets, restoring normal servo control.

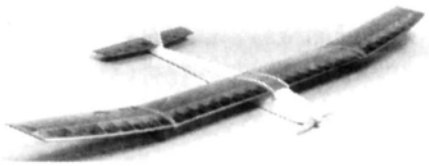
For more information, contact Century Systems, P.O. Box 868, El Toro, CA 92630.

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News,** or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News.**

WIHA TOOLS PRECISION SCREWDRIVERS

The Wiha precision tools, manufactured in West Germany and distributed by Bondhus Corp., are recognized as high-quality products. Technicians appreciate the durability of the hardened, tempered tool steel blades. Another important feature is the blade's unplated tip, which prevents over-sizing and chrome flaking. The molded-on handles are tapered for easy use and include a fingertip rotation cup for added control. Hex, Ballpoint, Nutdriver and Torx precision tools are also available, and all types come in sets or individual sizes.

For more information, contact Bondhus Corp., 1400 East Broadway, P.O. Box 660, Monticello, MN 55362.



ASTRO FLIGHT MINI CHALLENGER

The new Mini Challenger deluxe kit comes with Astro Flight's patented cobalt 035 motor and scimitar-shaped folding prop. The Mini Challenger is a small, more maneuverable version of its big sister, the Challenger. The Mini's wingspan is 60 inches with a wing area of 400 square inches and a flying weight of 30 ounces. The motor runs on 900mAh cells (compared to 1200mAh cells for most competitors) and gets the Mini Challenger straight up to thermal country in 30 seconds. The climb can be repeated three or four times in a single charge. Designed with machine-cut, sanded, select balsa and spruce spars, the airframe weighs a scant 11 ounces. The unique scimitar-shaped prop minimizes drag during flight and increases aerodynamic efficiency for increased glide time.

For more information, contact Astro Flight, Inc., 13311 Beach Ave., Marina del Ray, CA 90292.

LEISURE ELECTRONICS STREAMLINED GEARBOX

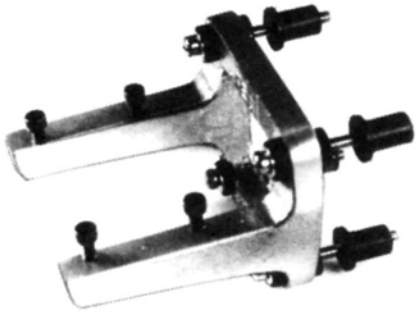
Designers of electric-powered gliders no longer have to compromise the aerodynamic qualities of their designs because of the bulky, short-shaft configuration of electric motors. Leisure Electronics has introduced a new, streamlined gearbox with extension shaft that allows the motor to be located back in the thicker section of the fuselage. By pushing the motor back, the designer also gains more freedom in placement of the center of gravity. Leisure's streamlined gearbox and extension shaft are available separately (No. 6015), with stock motor (No. 503L), or with competition motor (No. 603XL). The new gearbox and extension shaft with motor are offered in the Airtronics Eclipse Kit and can be easily installed as modifications in other electric gliders.

For more information, contact Leisure Electronics, Inc, 22971 B Triton Way, Laguna Hills, CA 92653.

R/C EXTRAS TAYLORCRAFT

R/C Extras is proud to announce its latest kit: Jim Hiller's clipped-wing Taylorcraft, revised by R/C Extras. This 1/4-scale sport model has a 90-inch wingspan and 1300 square inches with a semi-symmetrical airfoil. A highly aerobatic model of the finest quality, the kit includes plans, cowl, windshield, landing gear and wing-rib sets; all wooden parts are hand-cut of the highest grade of balsa wood. (Wheel pants are optional.) The recommended engines are .90 to 1.5 2-stroke or 1.2 to 1.6 4-stroke. Price: $199.95, plus $10 shipping.

For more information, contact R/C Extras, RR #1, Box 28B, Sergeant Bluff, IA 51054.



J'TEC ISOLATION MOUNTS

J'Tec now offers Snuf-Vibe Isolation Engine Mounting Kits and Isolated Engine Mounts. Unlike other isolation mounts, the Snuf-Vibe system completely encases the engine-mounting bolts with neoprene rubber in the engine mount and in the fire wall for double protection! These kits contain four complete isolation sets and easy instructions for use with any cast-aluminum or glass-filled engine mounts. The kits are available in two sizes: JT-631SV (6-32 bolts), $7.95; and JT-832SV (8-32 bolts), $8.95.

For more information, contact J'Tec, 164 School St., Daly City, CA 94014.

WORLD ENGINES BLACK EAGLE ARF

The Black Eagle electric ARF airplane comes mostly pre-built. The fuselage is pre-assembled from balsa and plywoods, and the wing and stabilizer come pre-built and covered with tissue. Just join the three wing pieces, glue on the vertical fin and stabilizer, attach the motor, attach the landing gear and wheels, and install the radio. Although no additional covering is necessary, it can be covered with any heat-shrink material, or it can be painted with regular dope. The kit comes with an RS-540 motor, a balanced 7x6 prop, hardened pre-bent wire landing gear, wheels and all the hardware needed to complete the kit.

For more information, contact World Engines, 8960 Rossash Rd., Cincinnati, OH 45236.

Jet Blast

by SONNY SISTRUNK, guest columnist

Austin, Texas—hotbed of fan activity—hosts its own fan fly

THE AUSTIN Radio Control Association (ARCA) held its first annual Fan Fly on July 8 and 9, '89. The summer sun was hot throughout the weekend, but never as sizzling as the performances. With over 3,000 spectators, a total of 26 entrants brandishing 37 high-performance ducted-fan jets participated in six categories of competition.

The many spectators get a close-up view of planes and pilots during this one-hour special static display.

This event offered some of the best entertainment that R/C can offer. The flight line was closed to flying for one hour each day, which gave the spectators the opportunity to get a close look at the planes and pilots. ARCA president Rick Schafer conducted classes on the more functional aspects of the hobby, and Saturday evening, club members Bobby Zieger and Mike Kulczyk gave a highly professional presentation on scratch-building techniques.

The six categories of competition were Technical Achievement, Best Non-Scale Performance, Most Outstanding Scale Performance, Slowest Jet, Fastest Jet and Top Gun.

Jerry Warthan's F-4J twin-engined Phantom. Equipped with a drag chute, it's a combo that never fails to get the attention of onlookers.

Technical Achievement winner was Jerry Warthan from Arlington, TX, with his Twin-Fan F-4 Phantom, complete with drag chute. This plane brought cheers from the crowd when the chute deployed at landing. Ed Couch ran a close second in this event with his A-10 Warthog, but he had some minor mechanical problems in the No. 2 engine that limited his plane's performance.

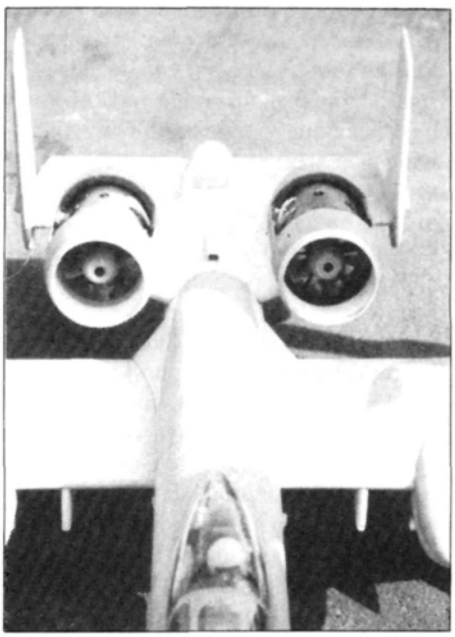
Best Non-Scale Performance winner was Jerry Caudle from Illinois with his Viper Jet. This yellow streak was also clocked at 159mph during the speed runs. Jerry put on an excellent performance, and the crowd really got to see what this plane is capable of!

Most Outstanding Scale Performance winner was ARCA member Terry Wysong of Austin, TX. His handling of the 1/4-scale BD-5J "Coors Silver Bullet" was electrically charged and held the crowd's attention every second. This plane is undergoing further development by Terry and such well-known modelers as Tom Sewell, Bob Price and Bobby Zieger.

Slowest Jet winner was Bill Fowler of San Antonio. With his F-16 by Byron, he was clocked by radar at a well-controlled 13mph. Both plane and pilot proved to be very stable and capable of extremely slow, stabilized flight. Bill also ran a close second for the Scale Performance category.

Fastest Jet winner was Vernon Montgomery from Clinton, MS, with his Viper Jet. Vernon was officially clocked at a searing 165mph during the speed competition, and what a super performance it was! Vernon demonstrated his ability to squeeze every ounce of performance from his plane.

Top Gun winner for the first annual ARCA Fan Fly was none other than Joe



An A-10 Warthog built and flown by Ed Couch. Engine problems prevented display of true capability.

Terry Wysong with his locally developed BD-5J "Coors Silver Bullet." Won Most Outstanding Scale Performance.

Bill Fowler displaying his "Slowest Jet" category winner. No one could come close to his 13mph low-speed pass by the radar.

Joe Pastor and his F-15 Regal Eagle took the Top Gun title hands down. Joe put the crowd on its toes and against the fence during each of his dazzling runs.

Pastor, ace of the fan fly, with his F-15 Regal Eagle by Bob Parkinson's Models. His runway passes at six inches (or lower) put the spectators on the fence and applauding for more—a real crowd-pleaser! Joe's knowledge of his aircraft's envelope and his ability to safely use the full spectrum of his plane's performance were especially impressive.

Although this Fan Fly is primarily for high-performance fan jets, there were special guests to please everyone. A favorite for spectators and jet pilots alike was Curtis Youngblood, the 1987 World Helicopter Champion, who, along with Jack Holland and Greg Riede, put their birds through the paces. Curtis, from Bryan, TX, flies an X-Cell 60 in competition and is gearing up to defend his championship this year in Norfolk, VA. The best of luck to you, Curtis, for an outstanding performance.

Jack Holland came prepared with his crew chief, Janet Hoelscher, who believes in giving the aircraft a quick once-over before Jack wrings it out.

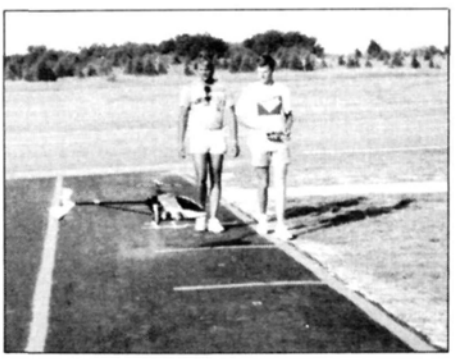
Another treat for the crowd was an exhibition speed run by Rick Schafer, contest director and president of ARCA. Clocked at 185mph with his Aggressor II, this speed demon is powered by the KBV 82 and a Quiet Pipe.

The participating pilots were given prizes of fuel, tote caddies and other door prizes provided by industry and local businesses. The radar equipment was graciously provided and operated by Doug Bickford of Command Hobbies.

Jim Marshall deserves an honorable mention for the outstanding job he did as master of ceremonies. Jim lives in Mission, TX, and is a member of the 165 MPH Plus Club. His quick wit and expert knowledge of the participating aircraft and their maneuvers capped off what turned out to be a very successful event.

Until next time... *fly it safe!* ■

Contest Director and President of ARCA, Rick Schafer displays his KBV 82-powered Aggressor II. This product of Bob Violett Models was clocked on radar at 185mph during an exhibition speed run.



1987 World Helicopter Champion Curtis Youngblood (white shirt) takes a stroll with his good friend, Jack Holland, and the X-Cell 60 helicopter they both love to fly in competition.

Doug Bickford graciously provided the radar equipment and his expertise to provide speed readings during the two-day event.

READERS' REPORTS!

We'd like you to participate in our "Readers' Reports" program, which was established to give you an opportunity to voice your opinion on products you've used. The guidelines are easy: Just send us a brief 3 or 4 paragraphs and a picture or two of any kit you've built or have underway. Tell us what you thought. If we use your report with one of our regular "Field and Bench" reviews of the same product, we'll award you a complimentary subscription to *MAN*. It's that easy. Participate! Make your views known.

Some of the kits now being reviewed:

Century Jet Sport Hawk
Ace All Star Bipe
Parkinson Regal Eagle
Global EZ Dago Red
Yellow Aircraft CAP-10
Global Extra 230
Kyosho Express electric
GMP Rebel
Miniature X-Cell 30
D&R P-51
Parma Aerosprint
Top Flite Elder Bipe
Midwest Aero Sport 40
Midwest Hots II
Sig Four-Star 40
O.S. Ryan
Global EZ F-16
Kyosho Electric Mustang
Dynaflite 40 Mustang
Bonded Roun-Tuit
Bob Violett Models F-86
EZ P-51 Dallas Doll

FIFTY YEARS AGO

(Continued from page 58)

of its "odd, thin fuselage," this ship could fly very slowly without stalling, and that was great for observation and mapping

British flier, Mr. Copeland. Beautiful plane, but without folding props, the Brits didn't stand a chance!

work, but it could also roar away at 245mph. Gas modelers, in particular, were encouraged to build the 0-46A because its "beautiful arrangement of wings and tail surfaces" made it especially good for them.

"There's a big job...sloppy climb, no power." So said a know-it-all pilot who was later forced to eat his words. The object of his ire?—Sal Taibi's 84-inch-span "Powerhouse"; and the sweetness of revenge is obvious as Sal goes on to describe the advantages of a big ship. He says that, given enough power, a big ship has considerable advantages when gliding. Following the insult, which he overheard at a local meet, Sal's plane was launched, gained a *tremendous* altitude in *20 seconds,* and was carried away by a strong wind when the motor cut out. A Cub was hired to look for the Powerhouse from the air, but at the end of the day, Sal returned home with only his pride and the certainty that he had developed a "fast-climbing, large gas job." Plans and pictures were provided of the plane that took more than a year to design and even longer to build successfully. So just watch what you say at the field; you never know who's listening!

The November '38 issue's coverage of the International Wakefield Competition relied heavily on photographs to communicate the excitement of the event. Held in Bendix, NJ, it was a great day for Americans as Dick Korda not only won the contest, but also established a new international record with his flight of 43 minutes, 10 seconds. Of course, he had *folding* blades on his propeller!

In contrast, all the British entrants had rigid blades, which of course, reduced their air time. It seems that the Brits believed the contest could be won without the aid of thermals, and they relied on the performance of the ship under power rather than on soaring. While they had "some very beautiful ships," they didn't have the winning edge.

Finally: What do S.A Marvin and Gary Smith have in common? They both brought a smile to *my* face (and that isn't easy to do!). In the April issue, this column included a 1939 picture of the members of the Marshfield Gas Model Club from Marshfield, WI. To my delight, the club's original secretary, Mr. Marvin (who was the one shown holding the communal plane) wrote from his present home in California, and he'd love to hear from the others. He says the 25 cents a week that each member contributed was "hard to come by" and that the Baby

(Continued on page 116)

The Freedom 20.™ Proof positiv

The Freedom 20's instruction booklet makes building easy—even if you've never built a model before.

Clear illustrations guide you through every step of construction and equipment installation. Covering materials and techniques are described, plus there's a section on adjusting and flying your plane.

FIFTY YEARS AGO

(Continued from page 114)

Cylone gas engine "was the very devil to start and keep running, but had the power to do the job." He thinks that the engine cost "in the neighborhood of $12—eight weeks' income for the club," and ads in the November '39 issue show he's absolutely right. Any other Marshfielders out there can write to Mr. Marvin c/o me at this address.

Gary Smith sent a very interesting letter about Mike Roll, who appeared in *MAN's* September '39 issue and again, this year, in "Fifty Years Ago." In '39, Mike was a Berryloid winner, placing third, and seeing his picture prompted Gary to tell us more about this remarkable, modest man. Gary had known him for four years, and at the '84 Nats (at the suggestion of his wife) he asked Mike what he did for a living. He wasn't surprised to hear that this expert modeler who had several successful designs to his credit was also an aeronautical engineer; but hearing that he'd been blithely rubbing shoulders with the NASA engineer in charge of the first and fourth *moon shots* really knocked Gary's socks off! Unfortunately, Gary's letter also brought bad news: Mike died in 1984.

Fifty years ago, the World Series was won by New York, who defeated Cincinnati, and the top tunes included "Three Little Fishes" and "I'll Never Smile Again." (Many must have found the latter particularly appropriate at that time.)

After a grueling day at my desk, Dorothy's words come back to me: "There's no place like home..." So, I'll just get onto my broomstick...! ■

SMALL STEPS

(Continued from page 24)

design. This got me thinking about trying my hand at designing a model. Well, the pictures show the result, the Kestrel.

"The Kestrel is powered by a Cox Babe Bee .049 engine, with a wingspan of 40 inches, and has dihedral of 7 degrees per side. The chord is 6 1/4 inches and the area works out to be 260 square inches. The plane weighs 16 ounces and has a 'Volumetric' loading of .065. The fuselage length is 28 1/2 inches. I have a 2-channel Cannon super Micro system that I bought for a much smaller plane that works just fine. It's covered with cream MonoKote with red trim.

"I really enjoy small aircraft; they're easier than larger airplanes in almost every respect. For instance, I started designing my plane over Christmas vacation and now, less than two months later, I am writing you a letter pending my completion! Compare that to about three years for some giant-scale jobs, and that two months was only an hour or so after school (I am 13 and in the eighth grade) and on weekends. Small planes are also much cheaper than larger planes; again, compare $13.95 for my engine (just perfect for my budget) to well over $100 for larger engines. I'm glad that you and Joe went through with the small-scale meet—I'm only sorry I couldn't be there. Keep up the good work!"

Wouldn't it be great to have several Ians in every model club? No one would worry about the future of model aviation!

The other picture is from a guy who has a little modeling experience himself, John Vasey of Austin, MN. Some of John's innovations have graced these pages before. John has been using hot-wire-sliced blue foam to make his own foam-core board. He uses a 50:50 mixture of white glue and water to attach different weights of paper to the foam: the heavier brown paper where more strength is needed and the thinner bond for areas of less stress.

Aside from weighting the parts down as the glue dries, to eliminate warping, John built a large frame, covered it with the paper, then applied a couple of coats of dope to the paper and allowed it to dry. After it had aged a while, he cut it free from the frame and used it to cover the foam. The photo shows the foam from start to a finished rudder, which has remained warp-free for over two years!

Using this technique, John built an ST .23-powered Mini Cat for a total cost of less than $5, not including wheels, covering and paint. He said the project was rather labor-intensive, but interesting!

Time, as well as airplanes, does fly; this column makes the 18th for me, and that translates into three years. You people must be something else to have put up with Joe and me for this long. Give yourselves a handshake, and please accept our most grateful thanks! ■

PT-ELECTRIC

(Continued from page 32)

FINAL ASSEMBLY: After gluing on the tail surfaces, the hinges are glued into place, and the pushrods are hooked up. The rest of the radio gear is mounted to the top of the battery compartment with servo-mounting tape. All surfaces were checked to make sure everything was neutral and that nothing would bind during operation. The model balanced perfectly with no additional weight.

PERFORMANCE: The initial test flights were carried out early in the morning in calm conditions. Everything was charged and checked out perfectly. There was only one thing left to do: *fly!*

I advanced the throttle stick, and the Novak* T-l speed control brought the Thrustmaster motor to life. A gentle shove, and the PT was on its way. Considering the model's size, that it's direct drive, and that it runs on a 6-cell pack, the climb-out was pretty good. The first flight was used to check out the control response, stall characteristics, and control and trim change when transitioning from power to glide.

Everything was straightforward, and there were no surprises. The elevator and rudder were responsive, but not overly sensitive: When the gliding power was off, they retained their authority even when flying at slow speeds. Power-on stalls tended to break to the left, and a gentle touch of up and right brought everything back under control. When gliding, stall was almost nonexistent, and it tended to be straight ahead with recovery in only a few feet. The transition from power to glide needed no trim change at all. This is a nice feature, as it's very difficult for novice pilots to re-trim when going from power-on to glide, especially if they're using power to gain altitude, shutting down to glide, then powering up again, and possibly repeating the procedure several times during one flight.

As the model made the last turn on final and glided toward the ground, I started to feed in a little up elevator and made a perfect touchdown.

On subsequent flights, I consistently timed the motor run at 5½ to 6 minutes. With the use of a Novak speed control, the motor run time can be extended to 8 minutes or more—plenty of time for a novice pilot to receive stick time with the help of an instructor.

Later in the day, when the glider pilots had arrived, I put in a flight that impressed even them. About two minutes into the motor run, I ran into a thermal and used this additional lift (along with power) to really gain altitude. After about 20 minutes, I flew the PT out of the thermal, as it was time for me to head home. Since then,

(Continued on page 118)

PT-ELECTRIC

(Continued from page 117)

I've had several good thermal flights, but none quite that long.

CONCLUSION: The PT-Electric has all the requirements of a good electric trainer; as a matter of fact, it's such a good flier that power pilots at a local field showed great interest in its abilities! With the help of an instructor, anyone should be able to master the fundamentals of R/C flying with the PT-Electric.

It's an enjoyable and easy-to-build project that will teach a novice a lot about model construction, covering, radio installation and basic electric model operation. As the name implies, it might truly be the "P"erfect "T"rainer!

**Here are the addresses of the companies mentioned in this article:*

Great Planes Model Manufacturers, *P.O. Box 4021, Champaign, IL 61820.*

Super MonoKote; *distributed by Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.*

Carl Goldberg Models, *4734 West Chicago Ave., Chicago, IL 60651.*

Pactra, *410 N. Michigan Ave., Rm 1280, Chicago, IL 60611.*

Novak Electronics, *128 C East Dyer Rd., Santa Ana, 92707.*

Mr. Sticker, *18081 Redondo Circle, Huntington, CA 92648.* ■

HIGH-POWERED

(Continued from page 38)

efficiency point, the "40" rating actually makes more sense, because the various power levels are roughly equivalent to what can be expected from a .40 4-stroke, a sport .40 and a racing .40, respectively. It eases the understanding a little when equivalents to a known standard are provided.

Drawing on my experience with electric boats and the rules of governing organizations some 20 years ago, and ob-

(Continued on page 128)

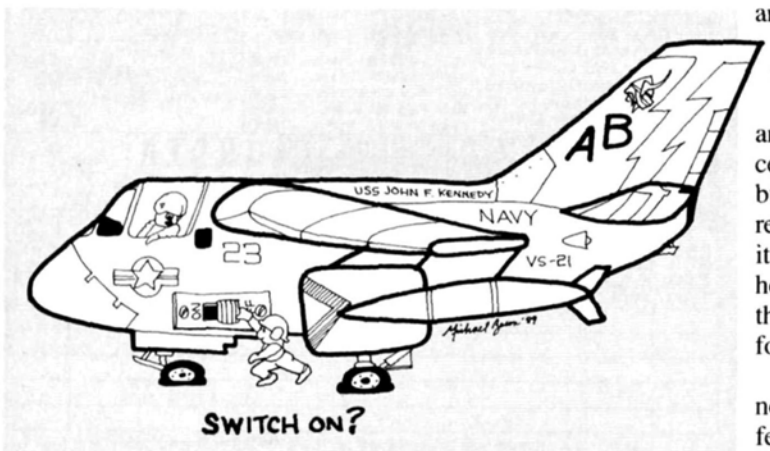
Sporty Scale Tec

by FRANK TIANO

THE LAST FEW months have definitely proved one thing: Some of those pattern guys, and many of those sport fliers, too, read this column! I've received lots of letters regarding the type of radio we so desperately need. It seems that the design of most current radios is *not* exactly what your doctor ordered, and, from the information you've provided, it also seems that the first radio company that gives us what we're looking for will get rich—quickly!

Brian O'Meara, a long-time Scale Masters competitor from Denver, says that he'd like to see some, or all, of the following features on his next radio: smooth face; metal sticks; push-button bomb-release switch that re-arms itself (great for Vortac-type release mechanisms); three-position switch for retracts, with adjustable pots for all three positions (!!*?$!) to facilitate landing-gear door operation; a 180-degree, non-proportional servo for the doors that's activated when the switch is in the No. 1 or No. 3 position to open or close them; a standard propo servo connected to the air valve or retract servo with a Y-harness; all rotary knobs replaced by slide-type switches and moved to the side of the transmitter case so you can reach them; and adjustable, 180-degree servos to go with these radios.

Vance Mosher's Westland Whirlwind twin. Unique subject uses even more unique material in its construction. Standard balsa/ply structure covered with "paper."



I definitely agree with Brian: We *need* something new in the fall fashion lineup. I also concur with many about various other subjects, e.g., that Bob Holman* may be the most-often overlooked source when we're trying to find something new or different to build. No baloney: If you get one of Bob's current catalogs, I'd bet three to one that you'd agree with me. He sells three-view drawings, working plans and semi-kits of almost every model aircraft ever designed, and if you like a certain airplane, but think you'd really rather have it a little bigger, he'll even blow the dang thing up for you!

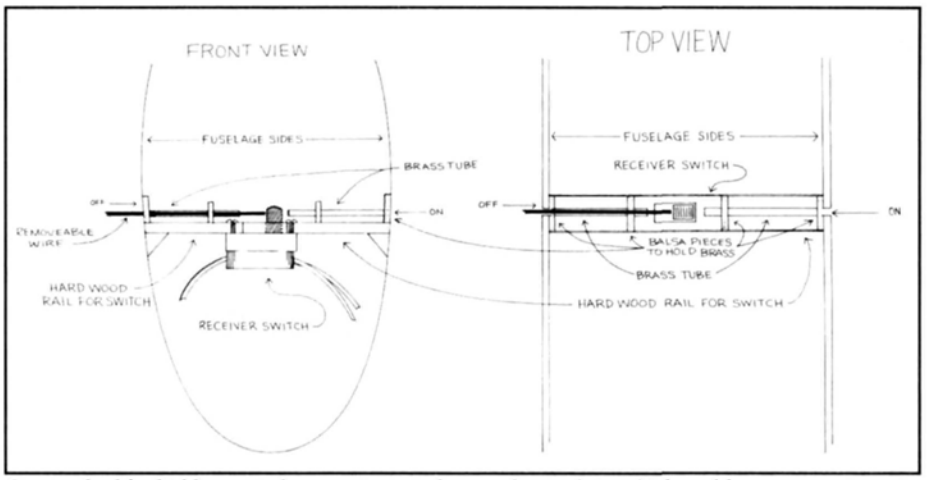
It's certainly no secret that the few scale model manufacturers have become rather stagnant over the last few years. I mean, we haven't exactly been overburdened with kit selections lately, have we? Not everybody is adept enough to design his or her own plans and loft ribs, plot bulkheads, synchronize stringers, or fabricate fillets, so look to Bob and get an eyeful. I promise that his catalog is the closest thing to a scale modeler's wish list that you'll ever see! (All three catalogs sell for only nine bucks.)

To all of you who have been putting off building a *real* electric-powered scale model: Your last reason for *not* getting with the program has just disappeared! Astro Flight* recently added a Cobalt 60 to its line of fantastic motors. This baby measures a full 2 inches in diameter, weighs 20 ounces and turns a 13x8 prop at 9,000rpm! This means you can easily fly a 12- or 13-pound model, and if you're noise conscious (and we all *should* be), this might be right up your alley. More than a few nationally known modelers are toying with the idea of electric-powered twins for the Scale Masters and the Nats.

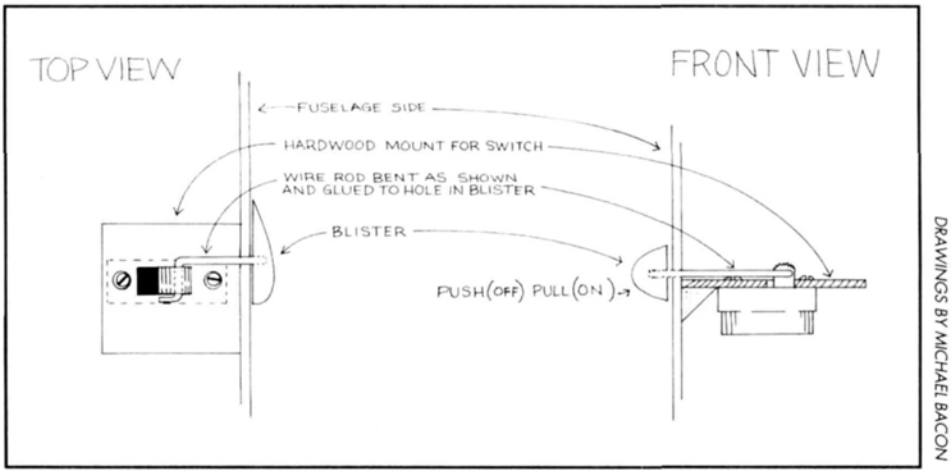
Top Gun

Much has happened since I last wrote about Top Gun. First, the Condors Radio

Control Club of Coral Springs, FL, announced that it won't be able to host the 1990 Top Gun Invitational at its field. It's really too bad, because the club did such an outstanding job last year. Since that decision wasn't announced until July 3, the Top Gun board had two choices: cancel the 1990 contest altogether and look for another site for 1991, or find another site—in a hurry! Well, I'm delighted to announce that the Arizona Model Aviators of Mesa, AZ, have just agreed to host the 1990 Top Gun competition. They promise to be such great hosts that the event will be the contest by which all others are judged for years to come. These people are real pros, and they love working under pressure almost as much as they love airplanes! They're offering us a 600x100-foot landing strip that even Chris Abate should be able to get adjacent to, and just for giggles, they've thrown in the same strip for takeoffs as well! Accommodations will be super-duper, at prices everyone can afford, and the festivities will be second to none. Watch the pages of *Model Airplane News* in the months to come for more details. With *MAN* and Pacer Technology working together with the Top Gun board, this will be one shoot-out that you won't want to miss. If you have to, plan to take time off work on April 26 through 29, 1990.



One method for hidden-switch actuation uses brass tube conduit, which enables an actuation wire to be used from either side to move switch to on or off position. Only a small hole is visible on the exterior surface.



DRAWINGS BY MICHAEL BACON

Another method for switch actuation on scale models has actuating wire "camouflaged" by some surface detail, e.g., a fairing, gun blister, or cockpit entry step.

Shifty Switches

For this month's how-to, I suggest that you all take a good look at the one thing on the side of your scale model that you'll rarely find on the side of a full-scale airplane. No, it isn't the frozen stream of Zap that's taking up 15 percent of the left side of your canopy, and it isn't that gaping hole you cut in your cowl that will allow a Honda 350cc muffler to have clearance. It's that little black thing! That's right! We're talking about the on/off switch.

If we're really serious about scale modeling, we must be just as serious about removing anything that associates our aircraft with toys. Nothing on a scale model is as offensive as a switch! No; take that back: The charging jack that you most thoughtfully placed alongside the switch might just be equally offensive! So what do you do? Who do you call? Certainly not the switch fairy. You simply move the thing to an unobtrusive position. For an aircraft with an open cockpit or a sliding canopy, the cockpit is always a good choice. If that's impossible, try one of the two suggestions that Mike Bacon has drawn for you. In either case, you can actually have fun by allowing the others at the field to guess where you've hidden that dastardly little black device.

If you're competing, there's always some part of the aircraft that isn't possible to document (and you aren't required to document the whole thing, anyway), and these parts offer a lovely position for a small scoop or protrusion to which the switch can be connected. Some thoughtful modelers have even used a fuselage machine gun or cannon as a push/pull device to activate the switch. Next time you're at a scale contest, look around and

(Continued on page 141)

Golden Age of

by HAL "PAPPY" deBOLT

HERE'S NEWS from the Vintage R/C Society! Organizer Joe Beshar has passed the baton to its first President, John Worth, who is the AMA's executive director and will soon be retiring from that position. Along with John comes Art Schroeder (of *MAN* fame) who will edit the society's newsletter. With a pair like that, how can the VR/CS miss?

John Worth has been involved with R/C for over 40 years. It began in 1947 with a call from *Air Trails* magazine Editor, Al Lewis, who was looking for someone to design a unique model for a new brand of sub-miniature R/C, which he thought would increase R/C activity. Now we know that the Aerotrol did that, with John's Arden .09-powered model adding emphasis.

From this basic beginning, John, Ed Lorenz, Dick Coen and Vince Bentley formed the Control Research Corp., which dispensed information, parts and equipment to early R/Cers. Showing typical modesty, John doesn't mention how well the company promoted R/C in those early years. Control Research was later consolidated with Ace R/C, which we still depend on, 40 years later!

This transmitter, with its 9-foot whip antenna, as used by Massopust was a step forward; but, as you can see, it still had to be tuned!

Tom Massopust's 1960 Live Wire Trainer was successful using his own home-built radio, and it enticed him to continue in R/C.

The Live Wire Viscount on landing approach used a reed system. Tom Massopust says he enjoyed it most. He has kit and will have another for OT R/C.

John went on to guide the AMA through many troublesome years until it became the giant that we now appreciate. That took almost 30 years, so we know the VR/CS has a talented, experienced leader we can wholeheartedly support. He says that ideas are being considered and that the first VR/CS newsletter, which will include messages from well over 100 charter members, should be ready soon. Since it's a member-oriented organization, input is requested, and this will be used to guide the development of the Society during its formative stages. It's important that members let the organization know what they want.

Charles Poulton of Tampa, FL, is the number-one charter member, and a casual membership survey shows that 50 percent or more haven't read "Golden Age." The volume of mail received is a good indication of the *widespread* interest in OT R/C activity. Have you joined? It isn't too late! Write to John* with your suggestions; his address is shown at the end of this article.

Unexpected Connection

With R/C, one thing always seems to lead to another. Steven Kouzoujian of Flagstaff, AZ, says that while doing some research for school, he came across a 1946 issue of *Aviation* magazine, and he thought one of its articles would be of interest to us all. He couldn't have known how this info relates to the Purdue U. project I've already discussed, but it amply illustrates the vision displayed by the Purdue people.

Before discussing Steve's article, I'll tell you about something else. At a mid-'40s Nats (in Philly, I think), the Consolidated Vultee Aircraft Corp. (later Convair) added to the atmosphere with its demonstration of a large R/C flying boat. I can still remember a large pond adjacent to the flying field and the amazement with which we C/Lers (R/Cers were very few) greeted the brilliant yellow plane that floated on the water looking like something out of today's "Star Wars." C.V. had made a big effort to show us how sophis-

ticated modeling would become; this prototype was a 1/8-scale model with a span of nearly 14 feet.

Purdue's objective in the '30s was to evaluate the aerodynamics of new aircraft designs using scale R/C models. The Convair project appears to have been a part of that, adding hydrodynamics to the facets being investigated.

In the 1946 article sent in by Steve, author Ernest Stout (a hydrodynamics engineer) indicated that it was essential to know the probable capabilities of multi-million-dollar aircraft *before* their first flights. He explained that sophisticated wind tunnels *were thought* to be capable of providing precise performance information. Facilities to test engines were similar, even duplicating conditions found in deserts and the Arctic. The characteristics of flying-boat hulls were tested in "towing basins," in which a scale model was towed the length of the trough while scientists observed the reaction of the hull. (Only longitudinal observations were possible, but horizontal and yawing actions were obviously important, too.)

With this proposed new flying boat, power would be increased drastically, and the increased slipstream would have much more effect on the water than ever before. They thought it essential to know all about the effect of water turbulence on the hull, and it was determined that something more than a towing basin was needed to obtain this data. It would also be especially helpful to know the plane's characteristics during takeoffs and landings.

The link with Purdue? The method they used followed ideas developed there. Ernest Stout and the Convair engineering group would design a 1/8-scale model of the Convair Model 31 flying boat for R/C flight. Victor Welge and Convair's radio lab would develop the radio gear; and, in the same laboratory, Glen May would develop the control actuators, which are especially interesting and not unlike the very first "reed" servos.

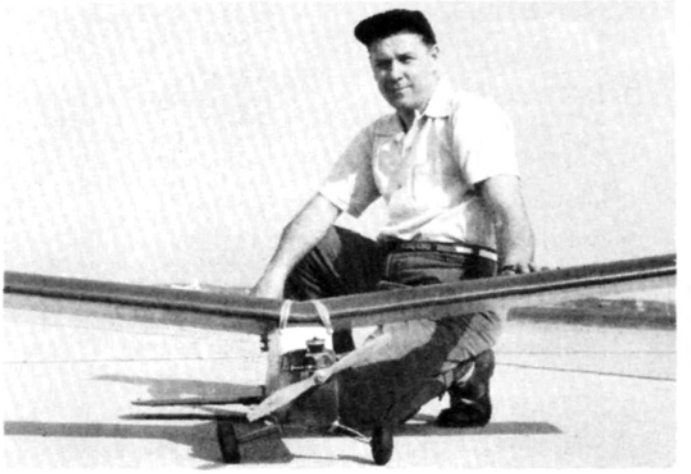
Amazingly, the actuators weighed only 2 3/4 ounces and used a miniature motor to drive a "jack-screw" reduction output of 14 pounds. I wonder if they were plagued by the jack-screw problem we encountered with servos using this method: In flight, the reverse force created by air loads to which the jack screw was subjected effectively *locked* the servo. If you used some down-elevator to enter a dive, when speed was gained, there was no way you could get the "down" out! We dived several models straight into the ground before bench tests revealed what the problem was! The simple jack screw was shown to be useless for R/C

Like the Purdue people, Mr. Stout had no previous information on which to rely, and everything had to be developed from scratch. Apparently, knowledge of the discoveries made at Purdue wasn't available to them. The 14-foot model was the *least* of their problems! The Convair model shop simply used our modeling methods and materials to produce a model that was exactly to scale. It's interesting that the sheet-balsa-covered wing had a greater strength-to-weight ratio than the full-scale plane would have! Its unique features were the sheet aluminum that was bonded to wooden spars and the use of Plexiglass for all fittings. Could this have been the forerunner of the injection-molded plastic fittings that we now find so useful?

For this twin-engine flying beast, with its projected weight of 80 pounds, there were no suitable engines, so its engine requirements were given to Ohlsson and Rice (who are certainly well-known to modelers), and considering Irwin Ohlsson's experience and ability, this was probably a smart move.

Eventually, the Ohlsson engines suited the plane very well and were said to be jewels of precision. These fantastic (for that time) engines were 2-stroke, opposed, 2.7 c.i. twins running on gasoline. Weighing a modest 3.4 pounds and fitting into a 9-inch cowl, they developed over 2hp at 5,000rpm. They even had carburetors! (We had to wait *years* more for those!) Even more outstanding were the alumi-

(Continued on page 139)



HE'S THE RETIRING executive director of the AMA and an OT R/C modeler we'll be hearing more about. His name? John Worth. His new job? He's president of our Vintage R/C Society.

His background is impressive: early R/Cer; NACA R/C developer; organized Control Research as an electronic supplier and manufacturer; AMA president and director for over 25 years. Still enjoys R/C, mostly E.P. A fine leader and true pioneer!

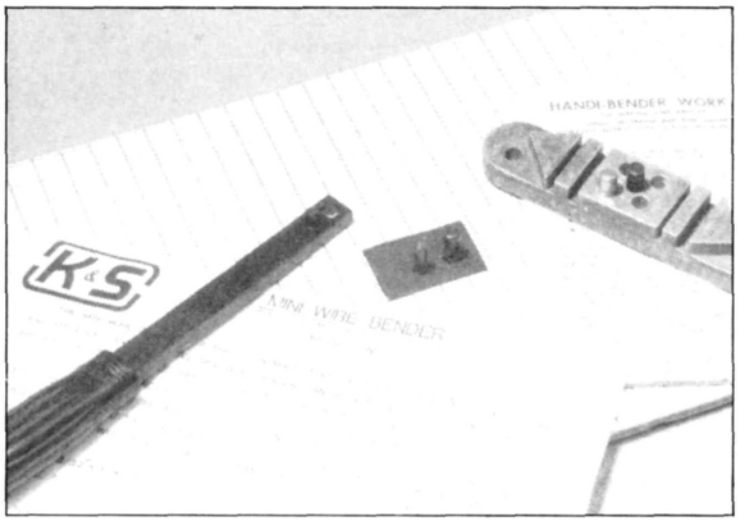
Building Model

by JOE WAGNER

ONE OF THE biggest problems facing modelers constructing their R/C airplanes from scratch is wire bending. If you make a mistake with a wooden or plastic part, it can usually be corrected without much trouble, but when you bend a piece of music wire in the wrong place, often, the only fix is to try again with a new length of wire. And if you mess *that* one up, too, what's supposed to be an enjoyable activity can become mighty frustrating.

With the right tools and techniques, though, bending wire precisely is easy. Too many modelers waste their time and materials trying to make do with just pliers for bending music wire. True, it *can* be done—particularly with wire less than 1/16 inch diameter. Even so, it's more difficult than most modelers realize to make a series of bends like those for a landing gear or biplane cabane struts, keeping them all in the same geometric plane. No matter how carefully you try to line up the jaws of the pliers with the previously made sections, the next bend always seems to be misaligned by a few degrees. And when you try to twist a misaligned part into line, some other angle invariably distorts in the process. No wonder many R/C modelers become discouraged with scratch-building!

Fortunately, there are a couple of inexpensive wire-bending tools on the market, and they greatly simplify this job. One of these is available for $5 or so from several mail-order tool-supply companies. It's sold under various proprietary names (e.g. Handi-Bender) and consists of an odd-shaped die-cast metal block that measures about 1x5 inches and contains five 1/4-inch holes in a central raised "pad" and two slots of different widths across either side. Steel dowel pins fit into the holes to provide leverage points around which to bend the wire. (You can also bend wire or sheet-metal strip in the slots.) By adjusting the length that the dowel pins protrude, it's even possible to produce multiple-turn "torsion springs" for nose-wheel struts on this tool.



These two wire-bending tools are described in this month's column. The K&S bender's center block has been imbedded in plywood (see text for details).

I've done a lot of my own wire forming with a Handi-Bender, and it works quite well—as long as I don't try pulling the free end of the wire around by hand. That invariably produces an unwanted curved section 1 inch or so long right alongside the desired bend. Correcting this isn't especially difficult, but it does take time, and it also makes it difficult to achieve the correct angle in the bend. It's better is to *push* the wire around the dowel pin with a hardwood block. This ensures that the wire next to the bend remains straight. Of course, to do this, the Handi-Bender itself must be *firmly* attached to something rigid. The tool has a countersunk hole at both ends for screw-mounting it to a workbench, but I prefer to clamp mine in a vise so that its position can be varied for different jobs.

Even better wire-bending tools are available now: K&S's* new Mighty and Mini Wire Benders. The Mini is for wire up to 1/8 inch in diameter; the much larger (and more expensive) Mighty is for 1/8- to 1/4-inch material.

These tools work well when used in accordance with their instruction sheets, but I've found a simple way of modifying these benders that makes them more suitable for jobs like making landing gears. My new setup guarantees perfect lineup of all the bends, and it completely eliminates "off-angled" axles, twisted struts and all the other pesky alignment problems associated with hand-bent LG wires.

Here's how I did the job on my K&S Mini Wire Bender: I carefully cut a precise 1x1 1/2-inch opening in the center of a piece of 1/8-inch birch plywood (6x12 inches is a good size for this, but an 8-inch-diameter circle would be even better). Then I press-fitted the steel-block portion of the bender into the hole in the plywood so that both upper surfaces were exactly even. I glued the two parts together firmly with thin CA; then, on the top surface, I applied grid-pattern self-adhesive shelf-lining plastic. (The grid helps me to judge bending angles, particularly when I have to make a slightly sharper bend.)

The new, larger, flat working surface provides excellent support and alignment for any multiple-bend wire (such as a landing gear) that's designed to have all its bends in a single geometric plane. To take advantage of this, you just have to use the tool's "handle" *upside-down*. That way, each successive bend is formed with the wire landing gear lying flat on the "support table." (The portion of the center steel block protruding below the plywood "table" is firmly clamped in a vise, of course.)

Now let's tackle the problem of *where* to make the bends. Both the Handi-Bender and the K&S tools wrap the wire

around steel dowel pins as they work. This produces neat "radiused" bends that are ideal for stress-carrying areas, but it's difficult to figure out exactly how to locate the wire alongside the dowel so that the bends will come out just where you want them.

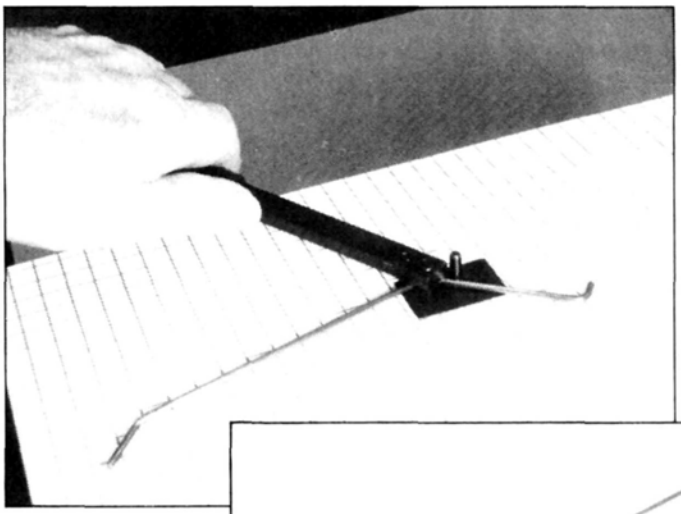
I usually do this job by marking the wire over its full-size pattern, one bend at a time. With a grease pencil or a felt-tip pen, I mark the wire at the center point of one bend. Then I put the wire in the bending tool with the mark just past the point where the wire touches the central steel dowel. After forming each bend, I put the wire back over the pattern to check for the proper angle.

If an angle isn't bent enough, it's easy to bend it more with the bending tool. If it's bent too much, it can be partly straightened by hand without much difficulty because of the trapped-in stress in the wire at the bend. When the angle is just right, I mark the position of the *next* bend on the wire, and proceed in the same way until the entire pattern is complete. (I always leave the axle lengths well oversize, and I cut them to the correct length only when the wheels and their retainers are in place. A Dremel cutoff wheel does this job quickly and neatly.)

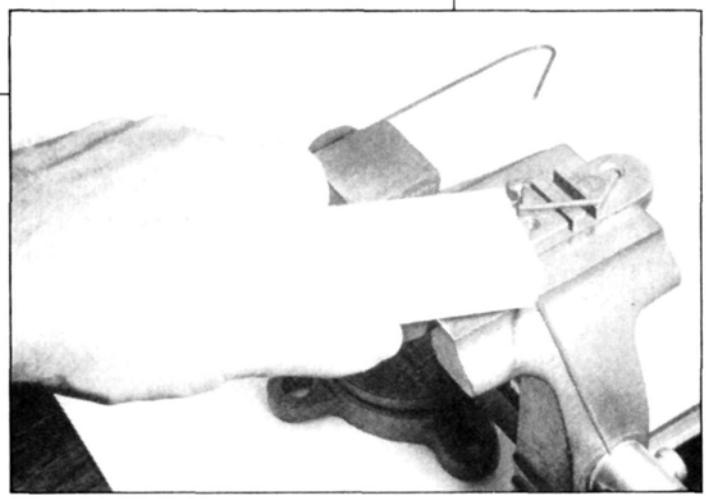
Absolute precision isn't usually necessary for parts like landing-gear wires. As long as the part is reasonably symmetrical, it could be as much as 1/8 inch off in any dimension without it having much effect. For biplane cabane struts, however, accuracy is essential. Whether the airplane will fly or not is utterly dependent on correct wing incidence!

To ensure that bends in wire parts come out precisely where they're supposed to, it's probably best to make test "mock-up" pieces first; coat-hanger wire works well for this. It bends just the same as music wire, but it doesn't spring back as much; it "wraps" around the bending tool exactly as music wire does, so you can precisely locate the bend marks on the wire for extreme accuracy.

Pliers still have a place in wire-bending, but I've found that the old-fashioned types—slip-joint, lineman's, long-nose, duckbill, etc.—aren't nearly as good as some of the newer designs. The problem is *grip strength*. It's all too easy for hard, slippery materials like music wire to move in the jaws of old-style pliers because of their limited leverage.



Precision wire bending is made simple with a slightly modified K&S Mini Wire Bender. A circular top would be even better than the rectangular one shown.



Bending wire on a Handi-Bender with a hardwood "pusher." In the background is an example of what happens when you pull the wire around instead.

Vise-grips—particularly the latest miniaturized versions—are excellent for freehand wire bending. The long-nose model is great for Z-bends: Just grip the wire *hard* where you want the middle of the Z to be; then, with a vise and a hammer, you can make that Z almost as sharply cornered as a printed one.

Another new kind of pliers I've found especially useful are the miniaturized water-pump pliers made by ChanneLock. They'll get into spaces as small as long-nose pliers will, but have a far more powerful grip. I use them frequently for hand-bending pushrod ends, gripping these to thread clevises onto, and for many other modeling jobs for which most modelers use long-noses. The tiny ChanneLocks work much better and never slip off as long-noses too often do.

As with many things, having the proper tools for the job makes the task at hand much simpler. In the case of accurately bending wire, the tools mentioned here are a salvation!

**Here's the address of the company mentioned in this article:*
***K&S Engineering,** 6917 West 59th St., Chicago, IL 60638. Tel: (312) 586-8503.* ■

HIGH-POWERED

(Continued from page 118)

serving what has happened with electric boats and airplanes in Europe more recently, I'm convinced that the only workable rule for competitions is one that limits the power supply; then modelers are free to use the available power at whatever level they want and are constrained by the power available from the batteries. In addition, and most important, one only has to count the number of cells and observe their size to ensure compliance with competition rules. Naturally, sport fliers will use whatever they need to have the fun they want...add a cell, take a cell...

I encourage all those organizing fun-fly electric events to also consider offering the competition events that always seem to accelerate the growth and development of new fields. I believe that the time will come, and that soon it will be possible to have aircraft in the AMA scale and pattern events that will perform just as if they had gas engines.

Some notes on safety: Those Ni-Cd cells can weld, and they can explode if they short out, so keep a pair of wire cutters handy in case of difficulty, and don't hesitate to use them if the need arises. A DC motor tries to maintain a constant rpm, so if you get a finger in the propeller, each successive blow will probably be harder as the motor draws more amps to keep up the rpm. Use a fuse: A switch is *not* a safe substitute, although a shorting plug could be. Install it just before takeoff, and remove it as soon as you get to the model after it has landed. This isn't to save the motor; it's to save yourself and your friends when that monster turns on unexpectedly. Believe me, they can (and will) do just that, with potentially disastrous results!

I'd be pleased to provide interested electric modelers with more information. Just send a self-addressed, stamped envelope to Bill Young, 8106 Teesdale Ave., N. Hollywood CA 91605, or leave a message on Compuserve's Model Net, where I've up-loaded a program to estimate high-performance electric performance called HIPERE.BAS. See you there? ■

SOPHISTICATED LADY

(Continued from page 44)

sistant" tips.

The Goldberg Electric Power Pod consists of a pylon/motor cradle made of light plywood and plastic, a very light, vacuum-formed plastic cowling, a 550 turbo

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SOPHISTICATED LADY

(Continued from page 128)

motor (.05 size), a pre-finished wiring harness, a spinner, an 8x6 nylon propeller and all necessary hardware. The only additional item needed for an "electrifying" experience is a typical 1200mAh, 6-cell car battery.

Construction and installation of this power unit is simplicity itself, but I didn't like the throttle-controlled motor switch. Frankly, I thought it too fussy and unreliable, and I was proved right on its first test! The major problem was the thickness of the Futaba servo arms, which made it impossible to really secure a drive point for the linkage as described in the manual. The drive point consistently malfunctioned. In any event, the system I used was far simpler and very reliable. I used a lever-actuated sub-miniature switch mounted on the servo body with double-sided mounting tape and driven by the servo arm. This arrangement is a cinch to adjust, and it never fails. The switch comes from Radio Shack as Part No. 275-016. Just get one, inspect it with your servo in hand, and the system simply describes itself.

The cowling is a little fussy to trim and install neatly but, once again, patience will carry the day, and the overall effect is well worth the effort. The rear outlet cone is shown installed with two small screws. *Don't bother;* using CA, just glue it to one half of the cowl, and the job is done more neatly.

As tight as the radio space seems to be, the Sophisticated Lady will accept most available servos and receivers. A little planning is required, and you must use a square 500mAh airborne pack (the flat type won't fit). I didn't use a switch, since it was so easy to lift the canopy and plug the battery pack directly into the receiver.

I used my trusty, single-stick, Futaba* PCM system, which performed flawlessly as it always has these last few years. The covering is Coverite's* Black Baron film, which continues to be my favorite heat-shrink. I had wanted to keep this an all-Goldberg job by using Ultracote, but none was available in my area, and it hasn't been available for several months. I don't know what the problem is. The Lady is certainly very easy to "dress" with no tricky curves or compound surfaces, and two rolls of Black Baron did the job nicely.

Before covering, I filled all the "dings" and bad spots with a Borden product (I remember when milk was that outfit's only business)—Elmer's Redi-Spack Lite. This very light, easily sanded material is well worth investigating.

All surface throws were set as suggested in the instruction booklet, and they proved to be just right; CG was set in the middle of the two extremes described on the plans. Again, this was the "bingo" position. All-up weight, with the power pod installed, was 50 ounces for a wing loading of nearly 11 ounces per square foot—not bad by anyone's standards.

PERFORMANCE: No analysis is necessary. The Sophisticated Lady is a fine flying glider and, with electric power, it provides a relaxing way to spend a summer afternoon. There seems to be a variation in control-surface sensitivity between power-on and -off. (The prop blast hits the T-tail and probably accounts for this effect.) Don't dive the Lady; it's very clean and can build up a "head of steam" in the blink of an eyelash. The wings are sufficiently strong for all normal loads, but I'd be fearful of a very sharp pull-out! Even with the extra weight and drag of the power unit, the glider still soared beautifully.

I've never been enthusiastic about gliders, but the Sophisticated Lady has changed my mind. I thoroughly enjoyed building it, and I'm having even more fun flying it. Give yourself a treat; take your own Sophisticated Lady out on a date!

**Here are the addresses of the companies mentioned in this article:*
Carl Goldberg Models Inc., *4734 West Chicago Ave., Chicago, IL 60651.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*■

ELECTROSTREAK

(Continued from page 51)

worked very well and appear strong enough to handle the loads required.

Following hinge preparation, the rudder/fin and the stab/elevator are prehinged, and the control horns are installed. A special note on the rudder horn: Owing to the pull-pull rudder configuration, a control horn is mounted on both sides of the rudder. This is done very easily by marking the location of the holes on one horn and transferring them to the other horn. The horns are held together with the 2-56 screws and nuts provided in the hardware package. The rudder horns are slightly modified, leaving only one hole available to connect the control cable.

After you've prepared the stab/elevator and the rudder/fin, ensuring proper alignment is maintained, carefully mount the stab to the fuse. The instruction manual explains all the necessary precautions

(Continued on page 132)

ELECTROSTREAK

(Continued from page 130)

and suggested adjustments and measurements to ensure this is done accurately. The same care is taken in explaining the process of mounting the fin. Proper alignment is critical to a straight-flying aircraft..

After the fuse, fin and stab have become a complete assembly, wing construction follows. This process is accomplished much more easily than I can explain, and the instructions are quite clear; just follow them closely. This is the first plane I've built using both horizontal and vertical shear webs, but it seems logical and makes a strong, light structure.

The wing panels are joined with the 3/16-inch center rib between them. The kit includes one 7/16-inch-square and two 3/16-inch-square blocks to use as dihedral blocks. After sanding the center leading edge flat, install the fiberglass reinforcement tape. In building this or any other kit, I like to try new methods recommended by the manufacturer. Sometimes they *seem* strange, but often work quite well. After all, if you go through life with a closed mind, you will miss a lot of opportunities to learn! Anyway, I used 3M "77" spray adhesive to hold the glass in place and glued it down with CA. This is a fantastic glassing process: no fuss, no mess, no sticky epoxy.

After the wing has been built, trial-fit it to the fuselage, then carefully measure for alignment from the wing tips to the base of the fin. Drill the mounting hole through the wing and mounting plate, then tap the mounting plate for a 10-24 nylon mounting screw and harden the threads with CA. I had to buy a tap—an inexpensive, but necessary, item for most shops.

Next, shape the fairing block to fit on the wing center so that it blends in with the fuse front. This has to be one of the *worst* parts of building any model! I always have difficulty carving these fairing blocks to be symmetrical and smooth. After much cussing and frustration, I managed to get it to look quite good.

The ailerons are trimmed to length from the shaped stock, and the leading edge is sanded to an angle to achieve a tight fit against the wing trailing edge. The mount for the aileron servo is prepared and the servo pre-mounted. The ailerons are then pre-hinged in the same manner as the elevator and rudder, and the control horns are mounted.

At this point, compute the finished weight of the whole airframe. The instruction book lists the expected weight of each assembly, and, by weighing each on an accurate scale, you can predict the finished weight. If the airframe is too heavy at this point, you can sand off excess weight, drill lightening holes in the landing-gear doublers, decide to do away with the landing gear altogether, or use 800mAh batteries.

After sanding the entire structure smooth, I covered it with dark red Super MonoKote by Top Flite*. I used Goldberg* Ultracote for the yellow trim, and the "canopy" was done with chrome Black Baron* Presto. It sure looks good in flight with the sun reflecting off it.

I was unhappy with the lack of guidance provided for installing the motor. The only reference to installing a fuse in the motor circuit was in passing: You're told not to exceed 25 amps. The instructions addressed breaking in the motor and options for connectors, but they didn't include any diagrams to follow, and these would have been useful for someone new to electrics. I'm no pro at dealing with electrics, but I've been reading most of the columns in the periodicals and from the information gleaned there, I decided that, for safety, both a fuse and some method of disarming the circuit was necessary. I installed an auto-type fuse with bayonet-style connectors to the motor circuit. By cutting an access slot in the fuselage side, I can remove or reconnect the fuse with the battery and wing in place, thereby having a method of disarming the motor without the extra weight of an additional switch. The motor is controlled by a Victor Engineering* speed controller with a brake.

One advantage of the design of the Victor speed controller is that it uses optocoupling, which further isolates any possible radio interference. The speed controller came with a capacitor and diode to be installed in the circuit to reduce, or eliminate, the possibility of radio interference from the motor circuit. The Goldfire motor came with its own capacitor, and I installed both in the circuit just to play it safe.

Cooling of the motor, battery and speed controller is accomplished by a flow-through, ram-air method. This begins through the nose-block intakes: one below the motor, the other through the motor. The radio is installed without wrapping anything in foam: Electric motors don't vibrate like the reciprocating kind. The cooling air flows past the speed controller over the motor battery and exits the tail—simple and effective.

I installed my "Heinz 57" radio (Tower* transmitter, World mini receiver with two micro servos and one Futaba* S133 micro servo—all powered by a 225mAh battery), and the total radio weight was 5.3 ounces. The radio installation is *tight*. The radio battery is mounted with Velcro to the bottom of the fuse in front of the motor battery; the speed controller is mounted inside the front top of the fuse with Velcro. The receiver is mounted behind the rudder and elevator servos, again using Velcro, and the elevator and rudder servos are mounted as far to the rear of the wing opening as possible. To give you an idea of why this is so cramped, almost all of the area under the wing is occupied by the motor battery. It *is* tight, but it works.

The completed ElectroStreak weighed in at 42.8 ounces with the 2½-inch Williams Bros.* wheels mounted and the 7-cell, 1200mAh battery installed.

PERFORMANCE: Flying the ElectroStreak was something that I approached with much apprehension. Would it just dog out on me like some other electrics have? Would it fail to get off the ground, or just be totally unmanageable? The day to realize the fruits of my efforts was at hand. All controls were set to recommended throws; all batteries (receiver, transmitter, two batteries for the motor—a 7-cell 1200mAh and a 7-cell 800mAh) were charged the night before. Everything was ready for the first-flight photo session after work.

How does that saying go?—anything that can go wrong...? Well I peak-charged the 1200mAh pack, plugged everything in, secured the frequency, turned on the transmitter, turned on the receiver—nothing! Uh-oh! Somehow, the receiver switch had been turned on during the day and the battery was drained. Thank goodness for Ace* Fast Field Chargers: Within 30 or 40 minutes, the flight pack was back on line and I was ready for the moment of truth.

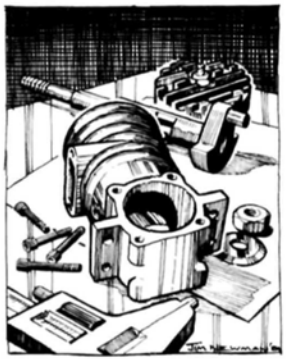
The first takeoff was from the runway. With the throttle up and the motor whining quietly, it tracked straight and broke ground after a roll-out of about 20 to 30 feet. The ailerons seemed sensitive, it climbed at a safe attitude, then turned slowly back for a flyby. As it was gaining altitude and I trimmed for first and second passes, the adrenaline was pumping! This thing was moving! After a quick trim set, a little aileron and a little elevator, it was flying level. This plane is *not* a trainer!

While watching (or flying) the ElectroStreak "streak," I think the best description that comes to mind was one word uttered by Editor Rich Uravitch: "Awesome!" It was eerie: this sleek plane with its profile zipping past with just a whine from its motor. The ElectroStreak is *fast:* It rolls fast, it flies fast, it responds fast and solid, and yes, it can do a Cuban-8 and stall turn. I was so preoccupied with doing flybys for the camera that it didn't even occur to me to do a snap roll.

I was definitely impressed with the performance of this aircraft. The adrenaline levels were high even into the second flight. By rough estimation, flight duration was about four minutes on the 1200mAh pack and approximately three minutes on the 800mAh pack; unfortunately, I was so excited that I forgot to time the *actual* length of the flight. I'll just say that although these times may seem short to wet fliers, it was very exciting.

Aside from the lack of guidance in selecting a method of wiring the motor, this is an excellent plane. Building is simple, and with the thorough guidance of the instruction book, this plane could be built by a almost anyone who has built at least one aircraft. However, this aircraft should

(Continued on page 136)



About Those En

by JOE WAGNER

MISCELLANY MONTH! FIRST on the agenda comes a correction. In a recent column, I mistakenly stated that the British-made Quickstart diesels (formerly Davies-Charleton, or "D-C") weren't available any more. I'm glad to learn that I was misinformed! Indy R/C Sales* carries them now; in fact, Indy is the new U.S. distributor. It's good to know that the lovely little .03 Dart (my own favorite Quickstart) is still on the market after all!

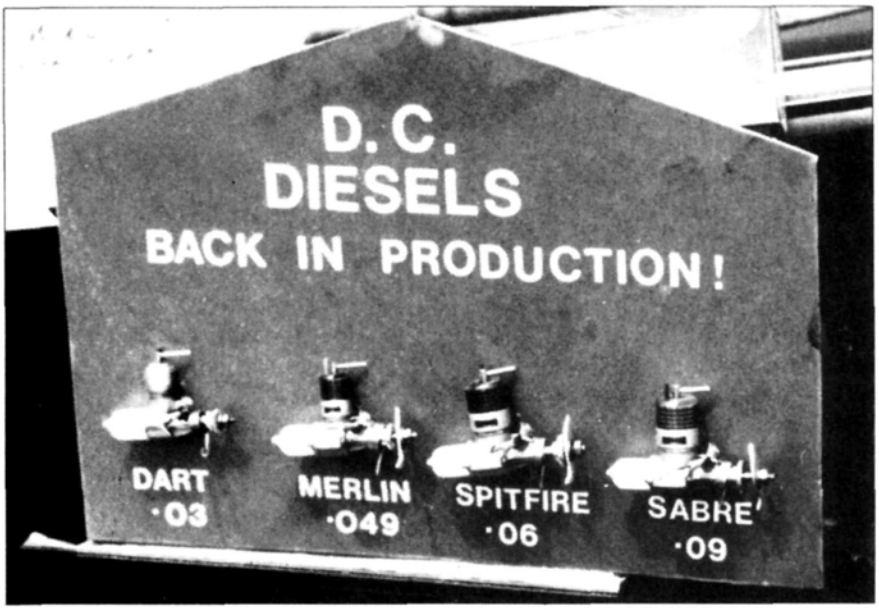
Another model engine I recently mentioned in this column has gone out of production, though. Bill Cannon* tells me that G-Mark isn't making its .30 radial 5-cylinder 2-stroke any longer. He has very few of these left in stock; when they're gone, there'll be no more.

Speaking of engine availability: I've been querying the few remaining suppliers of antique spark-ignition replicas in the hope of finding good news for fliers of R/C-assist OT models. I've just learned that Argo-USA* has some Edco Sky Devil .60s still on hand. (One was pictured in this column a few months back.) Argo-USA carries spark plugs and coils too. They're also the American source of several British-built model motors, notably the Elfin 2.49cc (.15-cubic-inch) diesels. Argo's owner, John Targos, told me yesterday that, sometime this fall, he *might* have Orwicks for sale again.

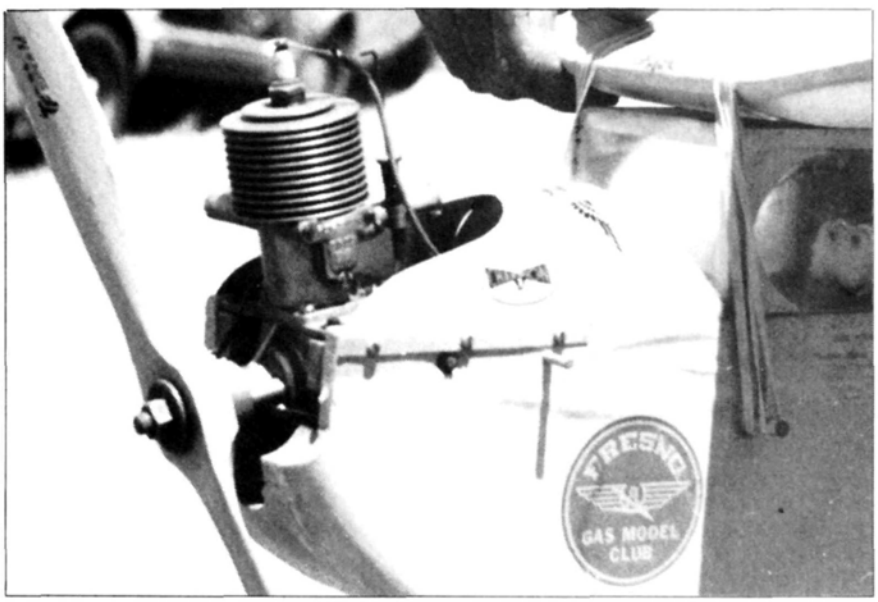
Moving on to a related topic: I occasionally receive letters from readers who have old-time model engines they'd like to sell, asking how much their antique motors are worth. Unfortunately, I find answering these inquiries a problem. The difficulty isn't that I'm uncertain about the value; it's that too many modelers have highly unrealistic expectations about what collectors will pay for yesteryear's model engines. A few readers seem to believe that after selling their '38 Bunch Mighty Midget, they'll never need to work again!

About three years ago, someone wrote to ask how much an Ace Twin he had was worth. (This was a .64 displacement opposed twin, made in California in 1947.) He enclosed a photo of his engine, and the thing looked fairly good, although, as I recall, it was missing a part or two. Anyway, I told him the Ace would probably bring somewhere around $300 or so, as is. He was very upset with my reply, and he wrote back to tell me off in no uncertain terms! He said that he *knew* this motor was worth well over a thousand bucks!

Here's how I'm able to estimate the

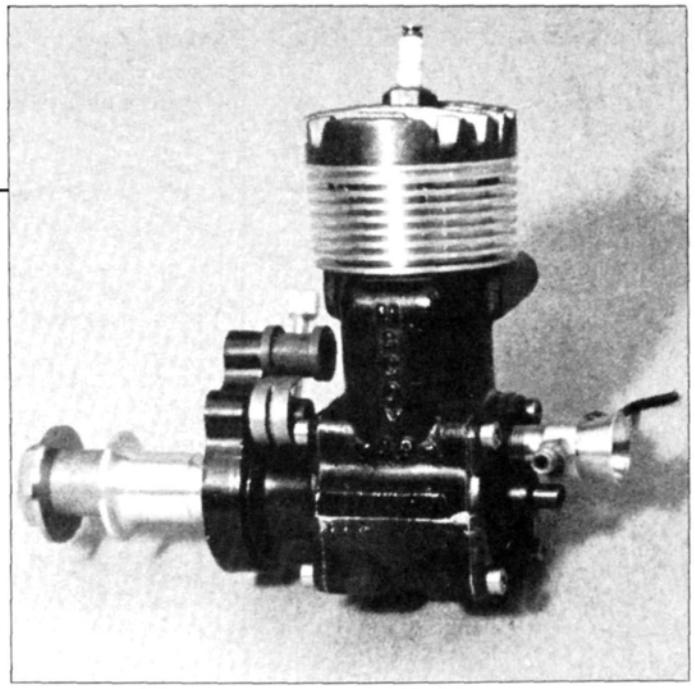


The sign tells the story, but the name is now Quickstart. Indy R/C carries them.



One of the first model engines used for R/C flying (well before WW II), the Forster .99 is a rarity now, yet it isn't worth a king's ransom, either to collectors or to OT fliers.

gines

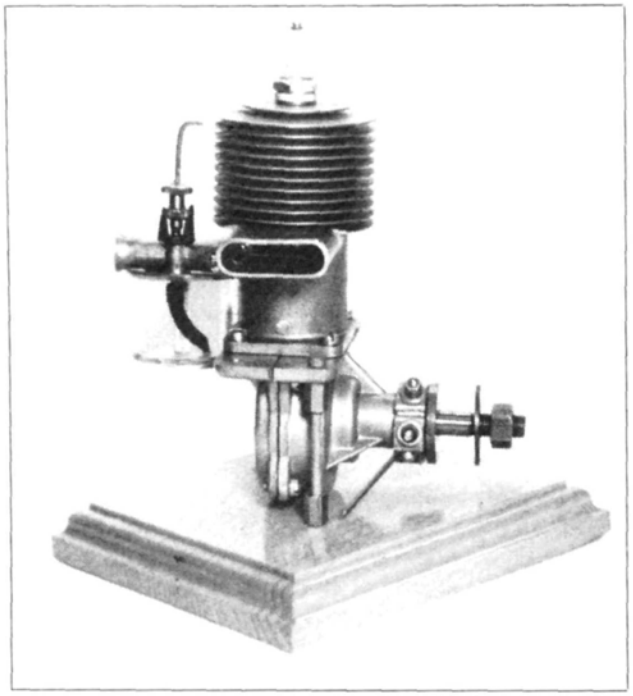


Ball-bearing rust troubles aren't new; racing engines like this McCoy Redhead had the same problem 40 years ago, when alcohol-based fuels began supplanting 3:1 gasoline-and-oil.

value of antique model engines: Model Engine Collectors' Association—MECA for short—is an international club with more than 1,200 members. As it happens, I'm the one who first organized this society, way back in 1958. (My friend, the late Bruce Underwood of Columbus, OH, first came up with the idea for a club of model engine collectors, but he was far too busy to do any organizational work on the project. I wasn't; so Bruce turned the job over to me.)

Although I'm no longer collecting model engines, and I no longer hold an official position in the group, I still receive the club's bimonthly swap sheet—more than 30 pages full of MECA members' ads. These list old motors, airplane kits, antique R/C equipment, old books and magazines—just about anything connected with the modeling hobby during the last 60 years. Most of this stuff is for sale or trade, and the price of each item is listed. That makes it easy for me to find out the current "going price" for most old model motors. If a reader writes to ask what his postwar 2-speed Forster 99 (or whatever) is worth, I check the latest swap sheet for this engine and average the prices. No guesswork is involved—except perhaps about the *exact* model of the engine.

Like gun collectors, model engine collectors value rare and unusual specimens more highly than run-of-the-mill types. As an example, almost a million Ohlsson .60s were produced between '40 and '55. They're quite common today, and aren't usually worth a lot—except for the very first version (the Custom, with a bronze eagle on the front of its case) and the very last (the "purple head" model). In between were at least a dozen variations: with brass or aluminum intake tubes; steel or aluminum head fins; small or large spark plugs, crankshafts, and exhaust stacks, etc. When I receive a letter asking, "How much is my Ohlsson .60 worth?" without a sharply focused photo accompanying the inquiry, I have to guess that the reader's motor is one of the common types, and make my estimate accordingly.



Many of the Forster .99s end up just like this one...adorning the display cases of collectors.

Corrosion Crisis

Corrosion problems with model engines keep turning up, although not as often now as a few years ago. Back then, about 25 percent of my readers' questions had to do with rusted ball bearings and other corrosion difficulties, but today's glow fuels are better, and most modelers aren't using bargain-basement stuff any more. All this helps to minimize corrosion in model airplane motors. I still occasionally receive another letter about ball-bearing rust-out. It seems the problem just *won't* go away!

I'm no analytical metallurgist, but during a 20-year career in aeronautical engineering, I've often had to investigate corrosion problems and come up with ways to overcome them. Lately, I've been looking into the causes of rust trouble in our miniature powerplants, and I've come up with some useful answers.

The problem seems primarily *electrical*. To explain this properly, I'll have to go into the fundamental chemistry of rusting. Rust is the combination of iron and oxygen—iron oxides, of course—but there's more to it than that. At room temperature, iron won't usually combine with oxygen at all, even though entirely surrounded by it in the air. Iron has to become extremely hot to join its molecules directly with those of oxygen, as anyone who's ever operated an acetylene cutting torch well knows.

With the assistance of a small electrical current, however, it's a very different story! Last year, rusting problems turned

(Continued on page 141)

Wanted:

AUTHORS CONTRIBUTORS PHOTOGRAPHERS

We think a lot of our readers have ideas that are worth sharing. How many times have you read an article and said, "I could do that!" or "That's not the only way to do that; mine's easier!" Could very well be! Here's your chance! We'll be expanding **Model Airplane News** and are looking for additional contributors to help us accomplish this objective. Of key importance is the ability to take good photographs; the writing we can help you with. Interested? It's much easier than you might think.

Let's hear from you. Send in your ideas, articles, thoughts and photos; we're looking forward to it.

RICH URAVITCH
MODEL AIRPLANE NEWS
AIR AGE PUBLISHING
251 DANBURY ROAD
WILTON, CT 06897

ELECTROSTREAK

(Continued from page 133)

not be flown by an inexperienced pilot: It goes where you point it, and it isn't self-leveling like most sport-type aircraft. If you feel the "need for speed" and don't want to get greasy, latch onto the ElectroStreak from Great Planes: You'll know you've grabbed hold of a mover.

**Here are the addresses of the companies mentioned in this article:*
Great Planes Model Distributor, *P.O. Box 4021, Champaign, IL 61820.*
Satellite City, *P.O. Box 836, Simi, CA 93062.*
Top Flite Models, *2635 S. Wabash Ave., Chicago, IL 60616.*
Carl Goldberg Models, *4734 West Chicago Ave., Chicago, IL 60651.*
Black Baron; *distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044.*
Victor Engineering, *380 Camino De Estrella, Suite 170, San Clemente, CA 92672.*
Tower Hobbies, *P.O. Box 778, Champaign, IL 61820.*
Futaba, *4 Studebaker, Irvine, CA 92718.*
Williams Bros., *181 Pawnee St., San Marcos, CA 92609.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.* ■

FUTABA 1024H

(Continued from page 91)

I've been able to put in a great many flights on several helicopters, and it has never missed a beat. It's a pleasure to have radios of such high quality and reliability.

There are, however, a couple of things I'd change:

- When entering the inverted flying mode, the elevator control reverses as needed, but the elevator trim does *not*. This means that, while flying inverted, if the nose has to be trimmed up, the level must be positioned to the more *down* position. It also means that any nose-down trim you may have in the helicopter to maintain forward flight while upright will then become nose-up trim when flying inverted. That will *really* get your attention when you first notice it! These effects can be minimized by flying upright with neutral elevator trim, so the trim will remain neutral while inverted. The Futaba PCM 8H had the elevator trim also reverse when inverted, and I wish they followed suit with the 9VH.
- One of the nice features of this transmitter is that it can be used with either the supplied PCM receiver or with an FM-type receiver that isn't PCM. Because the transmitter is of a digital design, however, and the FM receiver is of an analog design, the servos move in small, but definite, increments as they go through their travel. This is virtually unnoticeable in my helicopter except in the collective-pitch function, but I have to admit that I'm using 20 degrees of collective-pitch range in my X-Cell with a rotor-head speed of about 2,000rpm, and this makes the collective fairly sensitive. It's here that the hover altitude control is less than perfect because of this digital servo movement.

It's almost impossible to design a radio that's all things to all users, but the 9VH comes as close as any I've seen. A beginner won't need all the special features right away, and for more advanced fliers, I know of no other radio that gives so much control. If this review has done nothing more than whet your appetite to learn more about this new offering from Futaba, I'm happy.

**Here's the address of the company featured in this article:*
Futaba Corporation of America, *4 Studebaker, Irvine, CA 92718.* ■

HELI CHALLENGE

(Continued from page 96)

the throttle stick is pulled back past the center position on the transmitter, the collective pitch will change the pitch of the rotor blade to the negative side of the curve, and the throttle will reopen. This allows the helicopter to be flown easily through aerobatics, and it makes getting in and out of inverted flight a little simpler.

- For inverted flight using the invert system built into the transmitter, your radio system must have this feature (which is included in most of the higher-priced helicopter radio systems). The pitch curve must be tailored for inverted flight. Be sure that you enable the invert system at the transmitter! With many of the radio systems, enabling invert will automatically alter the pitch curve. If this is the case, you'll always have to fly with the invert system enabled (not *switched* to inverted; enabling only makes the invert switch active), so you'll have to be careful not to hit the switch at the wrong time! Ideally, you should set your machine up so that the hover point is just about half-throttle, and the upright pitch curve is pretty much the same as it is for normal flight. Flipping the invert switch will reverse the collective pitch, and the inverted pitch curve should be set so that it mirrors the upright curve. This usually doesn't work out exactly because of mechanical restrictions (e.g., the presence of any differential throw or mechanical offset in the collective system). If you have to compromise your pitch curve, you can give up some of the negative pitch, as

most helicopters actually require slightly less pitch to maintain inverted flight (compared with positive pitch required to maintain upright flight). If you're going to spend extended periods of time hovering upside-down, you might find yourself fiddling with the setup to get the rotor speed to match that of your upright hover.

If you're using your radio system's anti-torque tail-rotor compensation (ATS), you'll have to turn it off for inverted flight. Some radios have a switch on the outside of the transmitter for this; others do not. If you use the ATS, it needs to be reversed when the invert switch is activated. Most radio systems don't take this into account, and the ATS system doesn't reverse with the invert switch. The only solution is to shut the system down. You can continue to use your gyro, as this should perform satisfactorily in the inverted environment.

Now you're ready to fly. Start by checking out the new setup for normal flight. Make a few circuits, and trim your machine as best you can. With the helicopter in forward flight, and at a reasonable altitude that will permit you to recover from more than one mistake, roll the helicopter over to inverted. As it rolls over, reduce the throttle lever to a point at, or slightly below, the center position and flip on the invert switch. Reopen the throttle to recover into a slow, forward flight (but now you're inverted). To prevent some of the shock of the collective-pitch reversal, I like to reduce the throttle slightly; this way, the collective-pitch change is softened somewhat. Continue flying the helicopter at altitude in forward flight as if it were upright. If you get into trouble, don't panic: Simply roll the helicopter back to upright and flip the switch toward the normal flight position. (This

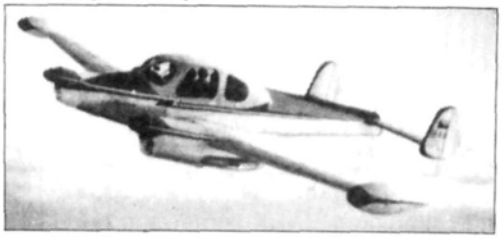
(Continued on page 138)

NAME THE PLANE CONTEST

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to **Model Airplane News**, Name the Plane Contest (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Brian Barker, a 13-year-old pattern pilot from Dallas, TX, for correctly identifying the Czechoslovakian LET L-200 Morava shown in our September issue. Brian's name was chosen from the 14 correct answers we received. He's either a very sharp aviation buff with a huge research library, or maybe he had a little help (perhaps both??), because the prototype L-200 made its maiden flight on April 8, 1957, nearly 20 years before Brian was born!



The five-place light twin is powered by a pair of 210hp Walter Minor M337s, which give it a maximum cruise speed of 183mph. Of conventional, all-metal construction, the Morava has a service ceiling of just over 20,000 feet and takes just short of a quarter of an hour to get there at its max rate of climb. The wingspan and length of the L-200 are 40 feet and 28 feet, respectively, and a large quantity of the type were sold to the Soviet Union for use by Aeroflot as air taxis. ■

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

HELI CHALLENGE

(Continued from page 137)

is why we're flying around at two mistakes high!) Keep working on inverted forward flight until you feel comfortable; then try a few climbs and descents. As you get the hang of it, get the machine down to a slightly lower altitude and bring it into a hover. Again, if you get into trouble, just power up and go back into forward flight. When you get used to looking at the helicopter upside-down, you'll find inverted flight quite easy; in fact, most fliers who are accomplished with inverted flight consider the set-up the hard part!

• For inverted flight using the high-idle method, your radio system must have a high-idle feature, and preferably, an independent, adjustable pitch curve for high idle. The setup parameters are similar to the invert-system pitch curve, except that, as the throttle stick is moved from low to high, the pitch curve will change from extreme negative pitch to positive pitch, and the throttle will be opened at both the low- and high-throttle positions. When you adjust the high idle, set the point adjustment to match the zero-pitch point in the pitch curve. ("Point" is the position of servo travel where the high-idle feature begins to function; usually, as the throttle stick is reduced from high to low, the throttle arm on the carburetor will continue to close.) With high idle, the carburetor will only close down to a point that you select with the transmitter; it will then reopen to your desired setting with the high-idle volume selection. Some radios don't use a point or position trimmer—only a volume setting—so don't be confused if your radio employs this type of high idle.

You're trying to achieve a setup that will allow you to fly upright with the throttle's collective control in the *upper* half of its travel, and to fly inverted with the throttle in the *lower* half of its travel. As the helicopter is rolled or looped onto its back, the throttle stick is moved down to the bottom (or low) position, giving negative pitch with enough throttle to maintain inverted flight. One major drawback to this setup is that the collective will become very touchy, and you'll find that basic hovering is more difficult than with a standard setup; for this reason, the independent pitch curve for high idle comes in handy. This will allow you to set up a normal pitch curve for hovering, etc., and when you're in forward flight, you can flip the high-idle switch and be ready for aerobatics and inverted flight.

Some of the new computer radios will allow you to set up an individual pitch and throttle curve for high idle; in fact, this is no longer called high idle, it's now called throttle position 1, or throt/pit 1, etc. With this system, you can setup for a constant rotor speed that will have the throttle follow collective pitch. As the throttle stick is pulled back, the collective pitch reduces and the throttle barrel closes. As the throttle stick continues to move lower (to around the zero-pitch point), the throttle will be set for an engine speed that gives normal-flight rotor speed. Continuing down with the throttle stick into negative pitch, the throttle will begin to open, again adding power to retain the same normal-flight rotor speed, until the throttle stick is in the full-low position where full-negative pitch is realized, and the throttle is

fully opened. It takes a little tinkering to get this setup to work perfectly, but when you've finished, the results are outstanding. You'll be able to put the helicopter into any attitude and fly right out of it; this will allow you to perform inside and outside maneuvers, etc., easily!

For the actual flying portion of the high-idle inverted method, have the helicopter in straight-and-level, semi-fast, forward flight. Roll the helicopter over, and as it comes to inverted, pull the throttle stick back until you're getting lift again. You'll need to pull back on the aft cyclic to keep the nose from coming up, instead of pushing on fore cyclic, as you would if the helicopter were upright in forward flight. None of your flight controls will be reversed, so you'll fly the helicopter much as you would an inverted fixed-wing aircraft, i.e., down is now up, and tail rotor is backwards, but roll remains the same. I think this method is easier to get used to, and it gives you much more control when doing aerobatics. You'll still need to practice quite a bit to become comfortable enough to get the machine down and hovering inverted, but you'll have a truly "omnidirectional" flying machine without flipping switches all the time. Anyone for a little inverted nose-on hovering? ■

CHARGE!

(Continued from page 105)

at any rate higher than 3.5 amps. They'll accept a *slightly* higher rate of charge, but the thin insulation between the battery plates will be damaged if you charge much higher than this. The increased capacity also translates into longer charging times, and at 3.5 amps, it could take up to 40 minutes. After use, you must let the pack cool for *24 hours*, but if this isn't possible, a *minimum* of 4 hours. (A 24-hour cooling is *definitely* preferable.)

Although it *isn't* recommended, they can be charged again within a relatively short period, but this will result in damage over the long term. The precautions you have to take when using this type of cell probably don't warrant its use in place of a 1200mAh pack, but if you want a slightly longer run time, this could be the way to go; you just need a few extra packs and some extra time. These cells are used by the modified cars, and they allow the cars to use stronger motors, but still last the 4 minutes it takes to complete a race. Flying doesn't usually require that you beat the clock!

Discharging

Despite the different *charging* techniques used for the various types of cells, the *discharging* techniques used for all cells are relatively similar. There are a number of ways to go about discharging, and these include using the charger's built-in discharger, or some type of resistor. The most popular resistor is a 30-ohm, 10-percent, 10-watt ceramic resistor. This resistor, which is widely used in the car world, simply uses up the charge remaining in the battery. It gets hot when plugged into the battery, and it stays hot until the battery is completely discharged.

You can also make a homemade version of a discharge resistor by soldering a battery plug to a common automobile brake-light bulb. The bulb will discharge the battery at roughly the same rate as a resistor, but the bonus is that you can *see* when the battery is discharged. The discharger circuit in the battery charger will also work just as well, but it will tie up the charger when you could be charging another pack. Why, you might ask, must the batteries be discharged when they're already nearly dead after powering the plane? I'll tell you:

The older Ni-Cd cells have a "memory," and when you constantly run down a battery only halfway, it will *get used* to discharging to this point. When you try to run the battery past this point, it will either go dead or run at a reduced voltage for the remainder of the charge. Even when the plane is out of power, use of a discharge resistor is recommended to eliminate the pack's "memory" and to ensure a full run each flight. The newer SCR and SCE cells aren't as susceptible to the memory effect, but it's still advisable to discharge them.

Electric-powered flight can be as enjoyable and easy as everyone says it is, and by using these charging and discharging techniques, you'll extend the life of your batteries and improve your plane's performance.

**Here's the address of the company mentioned in this article:*
***Sanyo Electric,** Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.* ■

GOLDEN AGE

(Continued from page 123)

num 3-blade propellers whose 2-foot diameters were perfect scale replicas of the 16-foot, full-scale, Curtiss Electric variable-pitch types. How would you like the job of producing the scale prop? At 4200rpm, the engines and props produced scale thrust (the forerunners of some of our most cherished giant-scale engines?)

Since that was in 1946, for the most part, the hobby still had nothing but simple single-channel radios, so the need for seven separate controls at the required low weight was a major problem. Remember: no transistors, I/Cs, mini relays or even Ni-Cds! Stout's article doesn't explain the exact nature of the radio, but there are clues that the final version used audio-coding channel separation—"band pass." This was perhaps the first use of tuned coils, which Convair developed and carefully produced. It took the Convair lab *14 months* of steady work to complete the radio! The final version was admirable,

(Continued on page 140)

Classified

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

SCALE DOCUMENTATION: Plan Enlarging. Photo packs, 3-view drawings for 1,600 aircraft. Super-scale R/C plans for Giant, Sport. 80-page catalog $4. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239.

PLANS ENLARGED, Large Scale Specialists. PC Model Software. Free information. Concept, P.O. Box 669E, Poway, CA 92064; (619) 486-2464.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

GIANT SCALE PLANS by Hostetler. We fly what we draw. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

STRIPPED GLOW PLUG THREADS REPAIRED with stainless steel Heli-coils. 2-stroke heads $7.50. 4-stroke $10, postpaid. Send head only. Lee Custom Engines, 10112 Woodward Ave., Sunland, CA 91040.

MAKE A BEERCAN BIPLANE, 9 inches with 14-inch wingspan, $9.95. Kit Three, Box 72104, Marietta, GA 30007.

ENGINES: IGNITION, GLOW, Collectors, runners, used, new. Sell, trade, buy. Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537.

OLD TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models.* A true collector's book from the early editors of *Model Airplane News.* It contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $1.75 S&H; Foreign Surface Mail, add $2.75; Foreign Airmail, $5.50; Payment must be made in U.S. funds drawn on a U.S. bank or by an International Money Order. Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

DISCOURAGED BY TOO-FAST R/C TRAINERS? Ease-of-flying ratings of over 30 popular trainers, $2. Jim Waterman, 3818 Deerfield Dr., San Antonio, TX 78218.

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ANTIQUE IGNITION AND GLOW PARTS CATALOG: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

EMBROIDERED EMBLEMS, Enameled Pins, Your Design, Excellent Quality, Free Booklet, A.T. Patch Co., Dept 68, P.O. Box 682, Littleton, NH 03561, (603) 444-3423.

WANTED: RTF U/C planes and U/C race cars, mite cars; complete or pieces, with or without engines. Buy or trade. John Fietze, Box 1521, Amagansett, NY 11930.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

RAZOR BLADES, single edge, carbon steel, first quality industrial. $5 per hundred plus 10% shipping. COBBIE'S GIFTS, RR 2, Box 454-A, Staunton, VA 24401, (703) 885-8036.

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Send ad and payment to *Model Airplane News,* 251 Danbury Rd., Wilton, CT 06897. **Non-Commercial classified ads** (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each. **Commercial classified ads** (rate applies to anyone selling on a commercial basis–retailers, manufacturers, etc.) Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number. **Closing Date** for either type of ad is the 20th of the third preceding month (for example, January 20th for the April issue.) We do not furnish box numbers. If you would like your ad run in more than one issue, multiply amount of payment by number of months that ad is to run. It is not our policy to send sample copies of tear sheets.

GOLDEN AGE

(Continued from page 139)

and everything (including the needed "giant tubes") was contained in a 6x6x15-inch box that weighed less than 20 pounds.

The article says that the pilot *sat at* the transmitter (perhaps like the "cockpit" the Purdue people envisioned?), had control of the two throttles, elevator, rudder, ailerons, flaps and ignition, and could duplicate full-scale action. (This seems to indicate proportional, but that seems highly unlikely.)

Considerable sophistication is indicated by the inclusion of a fail-safe feature that operated if transmitter contact was interrupted. The transmitter also included trim for all controls, and this would have been desirable and rather simple with an audio system. At that time, any R/C engineer would have thought it absolutely amazing that they were able to provide seven functions in *any manner!*

For the required performance records, the model was equipped with a special 8mm movie camera, which provided pictures of the takeoffs and landings and recorded trim settings, speed and time. Somehow, the camera was connected to one throttle and could be operated at will.

Another part of the project shows how far large corporations can go. They wanted data to compare the model with results obtained in a wind tunnel, and to get the data, a rolling support for the model was pushed to speed by an automobile. Apparently, the model was attached with a trunnion so that, at speed, the controls could be operated to change its attitude, as if it were airborne. Strain gauges were used to record the forces endured, and the results closely matched wind-tunnel data. (R/C simplified the effort, and the model was in little danger.)

Little is said about the actual flights, but results were apparently better than expected. The data obtained during takeoff runs, takeoffs and landings were studied and then experiments carried out with variations in CG and trim conditions, including flaps. The results obtained by the time the article was written were so encouraging that they contemplated more frequent use of R/C models for dynamic flight studies. They planned to investigate hydrofoils, hull shapes, high-lift devices and possible modifications to existing flying boats. Future projects would even include automatic pilots!

I wonder what the result of this first project was? I know that, at the Navy flight-test center during late '44 and '45, all testing of flying boats was drastically curtailed because there was allegedly no

longer a need for them. With the U.S. acquisition of Pacific islands, we had airstrips for land-based planes in even the broadest oceans. WW II had led to the development of many long-range planes; MATS (Military Air Transport Service) was routinely servicing our most far-flung bases with DC-4s and Connies. Off-water operation was a thing of the past; the day of the big boats was over.

As usual, the diehards were hard to convince. There were non-stop demonstration flights of 36 to 42 hours from Maryland to Africa, and to South America and back to Maryland, but all to no avail. Without a need for it, the promising Convair Model 31 never got off the water, but the *model* did!

We can assume that certain findings of the Convair project led to the success of the experiments at Purdue, even though they came one big war and many years later! Thanks, Steve Kauzoujian, for adding to our knowledge of early R/C.

Convair apparently had useable multi-channel systems, but it was nearly 10 years before our hobby had practical multi (reeds) and even longer before audio discrimination. Our progress came slowly!

OT Family

For some time, I've wanted to pass on info from Tom Massopust of West Allis, WI. Tom reflects the thoughts of many who say they enjoy "Golden Age." Already an avid modeler, in 1960, Tom *built* a radio system, and, needing a plane for it, he chose the L.W. Trainer. This combo introduced him to R/C and lit a fire that still burns today. He writes of the excitement produced by his first F&M commercial system; it even had a hand-held transmitter! As you'd expect, multi-reeds and proportional came as the years went by. For planes, he climbed up the Live Wire ladder with a Champion, a Pursuit, a P-Shooter and, finally, a Viscount, which was his favorite. (He still has a kit, and he plans to build it for OT R/C.) With Tom in the picture is his son, who was also bitten by the R/C bug. Now in his 30s, he's still active in R/C. Tom is a typical example of the many who have paid their dues, enjoyed modeling and stayed with it.

Don't forget that I'm waiting to hear from you!

**If you'd like to write to John Worth, here's his address: 4326 Andes Dr., Fairfax, VA 22030.* ■

ABOUT THOSE ENGINES

(Continued from page 135)

up in the front-wheel bearings of certain new automobiles. Investigation traced its cause to a defective grounding arrangement. Static electricity generated by the rolling tires conducted through the bearings, and that tiny amperage was enough to produce serious bearing rust, despite the thick grease surrounding everything.

The process is something like anodizing. Electron flow from negative (cathode) to positive (anode) transfers chemical as well as electrical energy. That allows chemical changes that would otherwise require high heat to take place at low temperatures. Look at a corroded carbon-zinc flashlight battery. Its outer shell turns into powdery zinc oxide, not at zinc's combustion temperature of 1,660 degrees F, but at a mere 70 degrees—all because of the tiny electrical current flow in the idle battery.

Well, ball bearings can become batteries too! The high-carbon steel from which most ball and roller bearings are made isn't a homogeneous material, but a sort of latticework of carbon and iron molecules (plus a few other elements, depending on the exact steel alloy). In the presence of a conductive liquid (called "electrolyte"), the carbon and iron will generate a current between them, and this will often be enough to start rust forming.

Neither tap water nor rain is much of an electrolyte; they don't conduct electricity well enough. (Salt water is something else, as anyone who drives a car in a state that salts its roads in winter knows!) Given time to do its work, however, even a poor electrolyte can initiate rust in a ball bearing, and once rust starts, it seems to feed on itself, getting worse and worse and *worse*....

I've discovered that the two major brands of glow fuel I've been using for the last few years are both electrolytes! Not strong ones, but they *do* conduct electricity. When iron and carbon electrodes were submerged in glow fuel, "Brand X" generated .34V, and "Brand Y" produced .30V. Perhaps that doesn't seem like a high voltage, but, as a comparison, saturated salt water gives .64V. This shows that high-quality glow fuel has about half the electrolytic potential—and corroding ability—of brine.

Could this be due to nitromethane decomposing into nitric acid in the fuel? Perhaps. The fuel I tested is at least a year old, but I also checked a can of Supersonic 1000 that's more than 25 years old, and it produced .36V—not much of an increase over the modern fuel, especially considering that Supersonic 1000 is 30 percent nitro.

What can we do about this situation? One solution would be to go to ball bearings made of 440C stainless. (They cost more than carbon steel, of course.) Other than that, I can only suggest doing what we already do: run our engines dry at the end of each flying session, then protect their innards with a flood of "after-run" oil of some sort. I use 3-in-1, but any of the name brands probably work just as well.

One more warning about ball bearings: *Never use magnetic tools of any kind around ball bearings!* Why? Because the steel used in bearings can be magnetized extremely easily. When they're magnetic, ball bearings hold onto their wear particles. Then, instead of being flushed away by the circulating fuel/oil mixture, the microscopic bits that wear off the balls and races cling magnetically to the bearing and grind it away as it spins. Don't let that happen to the bearings in any of *your* engines!

**Here are the addresses that are pertinent to this article:*
Argo-USA, *3229 Dianora Drive, Palos Verdes, CA 90274. (213) 377-6186*
Indy R/C Sales, Inc., *10620 N. College Ave., Indianapolis, IN 46280. (317) 846-0766*
Cannon R/C Systems, *2828 Cochran St., Suite 281, Simi Valley, CA 93065. (805) 581-5061* ■

SPORTY SCALE

(Continued from page 121)

see just how clever some scale modelers are about concealing such an obvious and necessary piece of equipment.

Wonderful Westland Whirlwind

Looking for a different way to cover and finish your new scale model? Take a gander at the absolutely gorgeous Westland

(Continued on page 143)

MODEL AIRPLANE NEWS

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For further details or information on our special introductory offer, call toll-free 1-800-243-6685 and ask for Katherine Tolliver.

CLUB OF THE MONTH

"IT'S A BEAUTY," said *MAN's* Editor when we showed him the Flying Hillbillies' logo; and our editorial department liked their newsletter, "The Hillbillie Hotline." Charleston, WV, is where you'll find this talented flock of fliers.

Don't let them fool you; this is a very well-organized club with *serious* issues to discuss: How can they stop pilots at their field flying improperly and, possibly, even causing injuries? How can they mollify the residents of Cannery Lane who live next to the flying field and complain about noisy planes flying over their houses?

Solutions are numerous. Were they *really* flying that far? President Ray Bocook and Chunky Cottle discovered that—yes—they really *were* flying 200 feet farther out than they had thought they were. "No wonder the residents are mad at us," they say.

So what have they done? They've moved the end-of-field pylons inwards to the edge of the mowed area, and they plan to move the takeoff strip and the mowed strip farther away from their neighbors. They also plan to buy a Db meter with which enforce the AMA's limitations on models' noise levels, and a warning sign will be posted to warn fliers that exceeding the limits shown by the field pylons will lead to expulsion from the club. They'll also institute a flight-training program to teach newcomers how to fly safely. They're *serious* about promoting good relations with their neighbors! Losing their field is unthinkable! They've worked so hard on it and will soon even have a *shelter*.

We hope they let us know how their attempts to save their field turn out. They obviously want to be good neighbors, and, since this is an "electric" issue... . Seems an obvious way to solve the noise problem? Two subscriptions are on their way to the Hillbillies; they have no shortage of deserving recipients! ■

SPORTY SCALE

(Continued from page 141)

Whirlwind built by Vance Mosher of Vancouver, WA. This 1/8-scale model spans 74 inches and weighs 9 pounds. Power comes from two Webra .28s swinging a pair of 11.5x4.5 Oriental props. What's really unusual about this model is that the entire airframe (except the nacelles) is covered with the material that's used for the cover of your favorite paperback! That's right, Cast Cote Cover is a special, lightweight paper that's pretreated to accept inks and paints. It works well with white glues and costs a mere 70 cents a square yard! You can find this miracle stuff in art and craft stores. The structure is conventional balsa and plywood where needed, and the paper stuff is applied everywhere a metal skin would be found on a real ship. Interesting, huh? Anyway, I gave Vance's address to Col. Steve Stunning, suggesting that he touch base with this lunatic: Seems Vance is willing to do a construction article on the Wessy, as well as an article on how to put your old Perry Masons to better use!

Well, scale fans, that's about it for this month. Before closing, I must advise you of the seven most important things to remember about this fantastic sport of scale modeling:

- Daisy BBs absolutely won't work as replacement bearings in your Cox .074.
- A landing-gear strut screwed to the output arm of a 180-degree retract servo might work...but not for very long.
- I know that an Aggressor is quick, but, regardless of what Mr. Violett says, it won't take off from a corn field.
- If you go to bed at 5 a.m. and get up at 6:30 a.m., rest assured that your overnight epoxy still isn't cured.
- Regardless of how far you pull them out, bolting on a set of rabbit ears won't improve your radio range.
- Norm Berger is *not* starting up a new scale magazine, and you should *not* send in your $19.95 for an advance five-year subscription.
- No matter what the cute hat-check girl in the fancy restaurant says, *never* check your six with her.

**Here's the address that's pertinent to this article:*
***Bob Holman Plans,** P.O. Box 741, San Bernadino, CA 92402.* ■

ADVERTISER INDEX